Telephony

November 9, 1935

THERMIONIC VACUUM TUBES In Telephony

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ARTICLE FOURTEEN in the series on fundamental principles of electricity for the telephone worker. This article is limited to a discussion of the types of thermionic tubes and their basic functions as rectifiers, amplifiers, oscillators, modulators, and demodulators. (End of Series)

THERMIONIC vacuum tubes, or just vacuum tubes as they are usually called, are of much interest to those in the telephone industry. These tubes have revolutionized long distance service and systems. They were, in fact, first used commercially in telephone repeaters. The term "thermionic vacuum tube" includes a vast number of devices. In all of these, a heated filament or *cathode* is used to emit the electrons; hence, the term "thermionic."

This article will consider only the types of thermionic tubes most widely used in telephone systems. The discussion will be further limited to the basic functions of the tubes as rectifiers, amplifiers, oscillators, modulators and demodulators, and will not include an extensive treatment of commercial equipment.

The Two-Electrode Tube: This device is shown in Fig. 1. If the filament, F, is heated by a current, I_f, from the A battery, and if the plate, P, is made positive by the B battery, a current, I_p will be indicated by the milliammeter in the plate circuit. This current consists of negative electrons which are thrown off by the hot filament and which are attracted to the *positive* plate. Since the *electrons* are flowing *down* through the milliammeter, the *conventional* direction of current flow is *up*; that is, from the plate to the filament.

The two-electrode tube is used as a *rectifier* of alternating current. A common arrangement is the full-wave rectifier of Fig. 2. The filament, F, is heated by current induced in the small coil, C_1. A high voltage, the magnitude depending on the direct-current voltage needed, is induced in C_2, and this voltage is impressed on the plates, P_1 and P_2.

The polarities of the two plates will be opposite at all times, since they are tied to opposite ends of the transformer. Thus, when P_1 is positive with respect to the filament, electrons will be attracted from the filament to plate P_1. These electrons will flow through the battery *to be charged* and back to the filament. Since the conventional current is opposite in direction to the electron flow, the battery to be charged is connected as shown. For charging, the current (conventional) should *enter* the positive terminal; that is, should flow *against* the battery voltage.

During the next half of the cycle, plate P_2 will be positive, and it will attract electrons. These will flow around through the battery and back to the filament. Thus, both halves of the alternating-current supply are rectified. In case the rectified direct-current voltage is to be used for such purposes as plate-voltage supply for thermionic tubes (as in radio sets), a filter consisting of series choke coils and shunted condensers is connected in place of the battery of Fig. 2.

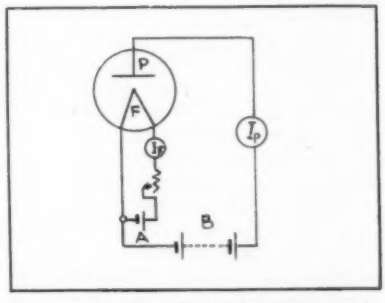

Fig. 1. A Two-Electrode Tube. The Positive Plate P Attracts the Electrons Thrown Off by the Hot Filament F.

The tubes just described are of the high-vacuum type. In these there is considerable resistance to the electron path from the filament to the plate. This is due to the *space charge* between the filament and plate.

This space-charge effect is caused by the electrons which have previously been thrown off from the heated filament. These negative electrons—as they hover about the filament as an electron cloud, and as they pass over to the positive plate—*repel* the new electrons which are leaving the filament.

In gas-filled and in mercury-vapor rectifier tubes, the negative electrons passing over to the positive plate collide with and break up or ionize the gas or mercury atoms. The atoms then become positive and negative

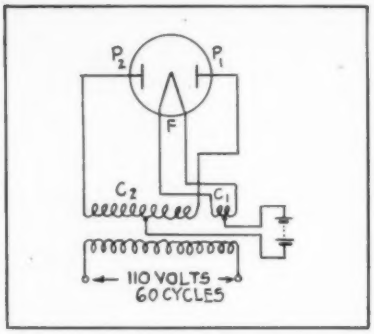

Fig. 2. A Full-Wave Rectifier. The Electrons from the Filament Are Attracted to the Positive Plate and Then Pass on Around the Circuit and Back to the Filament.

electric charges. The negative charges are chiefly small and rapidly-moving electrons, but the positive charges, which are the remainder of the atom, are massive and sluggish. The electrons, therefore, quickly move out of the path between the plate and filament, leaving the massive positive charges.

This accumulation of positive charges neutralizes the negative space charge previously mentioned, and hence makes it easier for the electrons to go from the filament to the plate. This, in effect, reduces the internal resistance of the tube, and hence reduces the voltage drop across the tube when it is rectifying current.

The Three-Electrode Tube: The three-electrode tube contains a filament, *F*, and a plate, *P*, with a third electrode, called a *grid*, *G*, inserted between these two as shown in Fig. 3. This grid is a wire mesh through which the electrons pass on their way from the hot filament to the positive plate.

Owing to the fact that the grid is much closer to the filament (which supplies the electrons) than is the plate, and to the fact that the electrons must pass through the grid to reach the plate, the grid can be used to control the electron flow to the plate. In other words, the grid makes possible the control action of a tube, and its use as an amplifier, oscillator, modulator, and demodulator.

Resistance-Coupled Amplifier: A resistance-couple (often called a resistance-capacitance coupled) amplifier is shown in Fig. 3, and the operating curve for the circuit is shown in Fig. 4. This curve shows the values of plate current, I_p which will flow in the circuit at different values of grid voltage, E_g. For operation as an amplifier (class A), the grid will be biased by the negative grid battery voltage, E_c. This negative voltage determines the point of operation, *P*, on the E_g-I_p curve.

Now, suppose that an alternating-current voltage is also impressed on the grid as shown in Fig. 3. This voltage may be from any source such as, for instance, from a telephone transmitter. When no alternating-current voltage is impressed on the circuit, the direct-current plate current flowing will be shown by the straight line. When the alternating-current voltage is impressed, however, the grid goes alternately less negative and more negative, and hence permits *more* plate current and *less* plate current flow as shown.

If the alternating-current voltage impressed on the grid exceeds the value shown in Fig. 4, the operation will *not* be confined to the straight

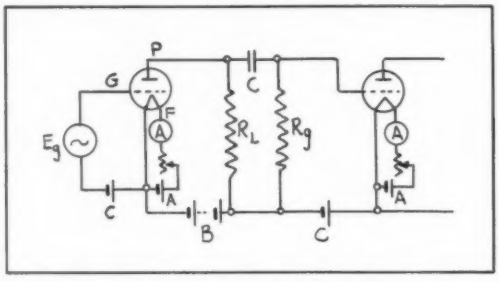

Fig. 3. A Resistance-Coupled Amplifier.

portion of the curve, and *distortion* will result. It is apparent that the *C* battery locates the *point of operation* on the curve. If this battery voltage is not correct, the point of operation, *P*, will be moved to up or down, and distortion may result.

The problem of amplification is usually one of starting out with a weak signal (or speech) voltage, amplifying this until it is of considerable magnitude, and then using this amplified voltage to drive a power output tube. The voltage gain per stage is, therefore, of importance, and this can be computed from Fig. 5.

The tube can be replaced by a generator of voltage, μE_g. The value, E_g, is the a-c voltage impressed on the grid of the tube, and μ is the *amplification factor* of the tube. This factor is a constant for each tube which merely states that a given voltage impressed on the grid is μ times as effective as a voltage in the plate circuit, because the grid, in its strategic position, controls the electron flow to the plate. The value of R_p is the plate resistance of the tube; that is, it is the internal resistance to alternating current flowing within the tube from filament to plate.

Considering only a-c variations, the a-c current through R_L in Fig. 5 will be $I_L = E/R = \mu E_g/(R_p + R_L)$. The voltage across R_L will be

$$E_L = I_L R_L = \mu E_g R_L/(R_p + R_L). \quad (1)$$

This is not only the voltage across R_L, but also, it is approximately the amplified voltage impressed on the grid of the second tube.

The condenser, *C*, of Fig. 3 is used to insulate the grid (which should be negative) of the second tube from the positive plate voltage furnished by the *B* battery of the first tube.

The resistor, R_g, is a grid leak resistance of the order of one or two million ohms; it is used to connect the grid to the filament. A free grid may pick up sufficient negative charge to "block" the tube. Thus, if *C* is large, say 0.01 microfarad or greater, and R_g is a million ohms, the voltage impressed on the grid of the second tube will be about the same as that across the resistor, R_L. The amplification of this amplifier is substantially the same over a wide frequency range.

In designing a resistance-coupled amplifier, using a tube having a $\mu = 9$ and a R_p of 10,000 ohms, R_L is usually about 3 to 5 times R_p. In this connection it should be remembered that the problem is *not* one of securing maximum *power* transfer, but one of securing a high voltage across R_L. For maximum power output, R_L should equal R_p; but for *maximum undistorted* power output, R_L should be about twice R_p.

Impedance-Coupled Amplifiers: It may appear that a value of R_L great-

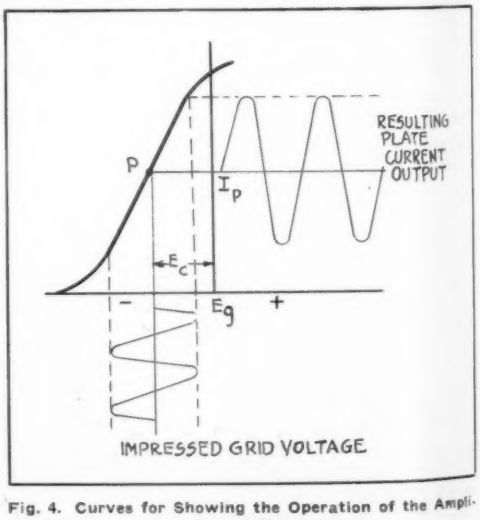

Fig. 4. Curves for Showing the Operation of the Amplifier of Fig. 3.

er than three to five times R_p would be advantageous in a resistance-coupled amplifier.

It is true that a higher value of R_L would give a higher voltage output, but a *higher value of direct-current plate voltage* would be required, and this is costly.

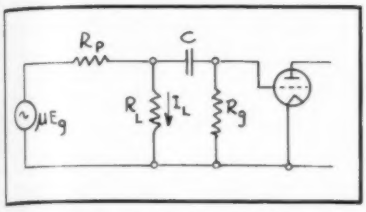

Fig. 5. From an A-C Standpoint, a Resistance-Coupled Amplifier May Be Simplified as Shown.

In the preceding section, little was said about the d-c plate current. This plate current must flow through R_L, and in so doing causes a drop in voltage. Suppose that $I_p = 0.005$ ampere, and R_L equals 50,000 ohms; then $E_L = I_p R_L = 25$ volts. Thus, if the B battery voltage is 90 volts, the actual plate voltage is only 65 volts.

If a choke coil having a low d-c resistance is used instead of the resistance R_L, there will be little opposition to the direct current and hence a low $I_p R$ drop. Thus, a smaller B battery can be used.

The a-c current through the coil will cause a large voltage drop, however, and this will be approximately equal to $E = IX = I2\pi fL$. As is evident, this voltage drop, which is approximately the voltage impressed on the grid of the second tube, varies with the frequency, f. The amplification of this amplifier would be different at various frequencies.

A condenser is sometimes connected across the coil to make a circuit which is anti-resonant at a certain frequency. The impedance offered to this anti-resonant frequency would be greatest, and hence maximum voltage would exist across it at this frequency. This maximum voltage would be impressed on the grid of the second tube and would cause the amplification to be greatest at this frequency.

As explained for resistance-coupled amplifiers, the purpose of the C battery is to keep the operation on the straight part of the grid voltage-plate current curve.

The Transformer-Coupled Amplifier: This amplifier is arranged as shown in Fig. 6. The transformer primary has low resistance and hence little d-c voltage drop in it. The amplified a-c voltage is "stepped up" by the turns ratio of the transformer and is impressed on the secondary. This secondary voltage is the voltage on the grid of the second tube. Thus, the transformer itself acts as a voltage amplifier and increases the voltage gain of the amplifier.

A complete analysis of a transformer-coupled amplifier is beyond the scope of this article. The transformer is not a perfect device, and its action in circuits is complicated by such factors as leakage of magnetic flux and by distributed and stray capacitances between the turns.

When good audio-frequency transformers such as are on the market today are used, and when these are properly selected and utilized, excellent results are obtained. The C battery keeps the operation on the straight part of the grid-voltage plate-current curve.

Oscillators: Thermionic tube oscillators are very useful in telephone work as sources of testing current, and in many other ways. This is especially true because they can be made to supply "pure" tones, and because the frequency can be easily varied when it is desired to run tests over a wide range.

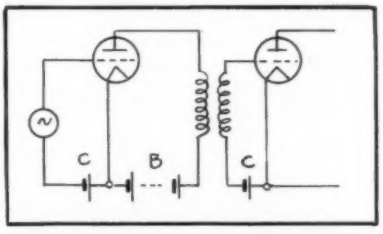

Fig. 6. In the Transformer-Coupled Amplifier, the Transformer Increases the Voltage Gain.

More power is put out by the plate circuit of an amplifier tube than is required to drive the grid circuit. Thus, if part of the output power is introduced back into the grid circuit, the amplifier tube will then drive itself and will *oscillate*. The frequency of oscillation is controlled by a tuned circuit consisting of inductance, L, and capacitance, C, connected as shown in Fig. 7. There are, of course, other circuits used, but this is a typical one.

The frequency of the output current is approximately equal to

$$f = 1/(2\pi\sqrt{LC}) \quad \ldots\ldots\ldots (2)$$

The frequency can be changed by varying either L or C, or by changing both.

Modulation: This is a process by which the high-frequency energy of a "carrier wave" is controlled by low-frequency impulses such as speech currents. In a sense, the high-frequency wave is made to "carry" the low-frequency intelligence. In telephone systems, carrier circuits make possible additional telephone and telegraph channels over existing lines and cables. In a typical system, three additional talking channels are obtained by a carrier system.

The radio station uses a modulated high-frequency carrier wave so that it will radiate and transmit more effectively. For example, if the low-frequency voice variations were impressed directly on an antenna, very little radiation would result.

Although modulation is often regarded as merely permitting more or less of the carrier wave to flow, actually modulation is the *creation* of new frequencies. Thus, modulation is really distortion and is produced in a circuit in which the grid bias voltage is made sufficiently negative so that operation is on the lower *curved* portion of Fig. 4.

In a modulating circuit such as might be used in a telephone carrier system, a carrier frequency of (for example) 25,000 cycles and the voice frequency of a commercial telephone system (varying from about 250 to 2,750 cycles) are both impressed on the grid of a tube which is biased so that operation is on the lower curved part of the characteristic curve of Fig. 4. With this bias the output will *not* be a replica of the input, but will be distorted and will contain new frequencies.

Among these is a frequency band equal to the carrier plus the voice, or a band from 25,250 to 27,750 cycles; this is the upper side band. In the output will also be a frequency of 24,750 to 22,250 cycles; this is the lower side band. If the modulating frequency is a pure tone of, for instance, 1,000 cycles, the upper side band will be a single frequency of 21,000 cycles and the lower side band will be a single frequency of 19,000 cycles.

The energy radiated from a radio broadcast station includes the carrier

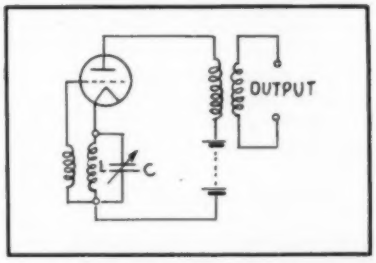

Fig. 7. An Oscillator With the Tuned Circuit L-C in the Plate Circuit.

frequency and both side bands, but both of these are not needed. In fact, only one side band and the carrier need to be transmitted, and even the carrier can be eliminated if it is resupplied at the receiving end from a

Answers to Problems in Thirteenth Article

The following are the answers to Problems 50 and 51 concerning principles of electricity, given in the thirteenth article of this series entitled "Telephone Transmitters and Receivers," published in the October 5 issue of TELEPHONY:

50. A. 0.0231 ampere.
    B. Voltage across each transmitter, 1.155 volts. Voltage across each receiver, 1.848 volts.
51. A. 0.00286 ampere.
    B. Voltage across each transmitter, 0.143 volt. Voltage across each receiver 2.860 volt.

local oscillator. In carrier telephone systems in general use in this country the carrier and one side band are transmitted.

Demodulation: This is the reverse of modulation. The inaudible high-frequency modulated side band (or bands) and the carrier frequency are impressed on a vacuum tube, which is operated with a high-grid-bias *C* battery so that it produces distortion. The distorted output of the plate circuit will contain many frequencies not present in the input; among these is the *original voice-frequency current* used to modulate the carrier at the sending end.

Thus, during the process of *modulation* the voice is impressed on a high-frequency (and often inaudible) carrier wave and the modulated carrier side band (also often inaudible) is transmitted to the receiving end. Here the side band and the carrier (either transmitted or produced locally) are *demodulated* and the audible voice-frequency results.

There are a number of ways in which thermionic tubes are used as demodulators or detectors. Of these, only one method will be considered; this is the general scheme usually employed in telephone carrier systems. Thus, suppose that a side band and a carrier are impressed on the grid of a tube so biased that distortion results.

These relations are shown in Fig. 8, where it is assumed that the side band is modulated by a pure tone of, for example, 1,000 cycles. The distorted output will now contain an audible component corresponding to the modulating tone of 1,000 cycles. This audible component is shown by the dotted line.

Summary: Thermionic tubes are extensively used in the telephone industry. They are used to rectify alternating current for d-c power supplies and for battery charging.

The three-electrode tube is used as an amplifier or repeater of telephone signals. When so used, the *C* bias voltage is so adjusted that the tube operates on the straight part of the grid-voltage plate-current characteristic curve. Then the output current is amplified and is almost an exact replica of the input voltage. If some of the output power is impressed back into the input circuit, the tube operates as an oscillator or generator of an a-c voltage of adjustable frequency.

When the grid bias is increased so that the tube operates on the lower curved part of the grid voltage-plate current curve, then the output current is distorted and is not the same as the input voltage. By operating in this manner the tube can be used as a modulator or as a demodulator.

Problems:

52. A resistance-coupled amplifier is arranged as in Fig. 3. The amplification factor of the tube is 9.3 and the plate resistance is 10,300 ohms. The value, R_L, is 40,000 ohms, and 0.1 volt is impressed on the grid.

a. What a-c voltage drop will be across the grid of the second tube if *C* and R_g are neglected?

b. Compute the ratio of voltage amplification and compare with the theoretical value of the tube.

53. With 90 volts *on the plate* and —4.5 volts on the grid, the d-c plate current is 2.5 milliamperes. What must be the value of the B battery in Fig. 3 to provide 90 volts on the plate? The value of R_L is 40,000 ohms.

Work out the answers to these problems and compare with the correct answers, which are published on page 26 of this issue.

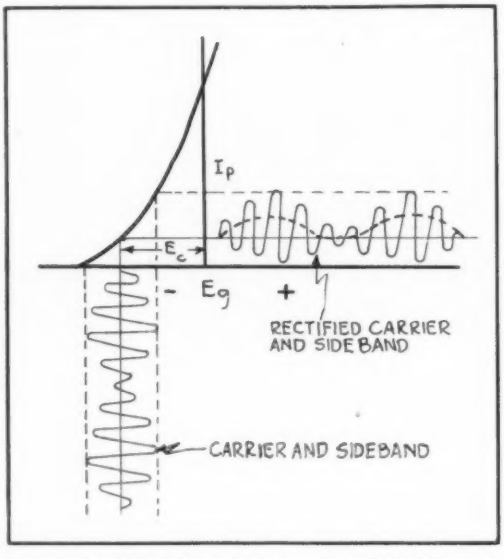

Fig. 8. An Illustration of Plate Circuit Detection. The Dotted Line Represents the Detected Audio-Frequency Component.

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First Communication Line in York, Neb., in 80's

The first telephone communication system in York, Neb., installed in 1880, consisted of two tin cans and a length of wire. One can was installed on the wall of the office of Captain N. P. Lundeen, on the north side of the city square, and the other can was mounted on the wall in the city depot of the Burlington railroad, eight blocks away.

"Necessity was the mother of invention" in this as in countless other instances. In the early days of rail transportation in the Middle West, train service to York was limited and irregular.

People wishing to meet friends or relatives expected to arrive on a certain train were forced to wait for hours in the station or make a second trip to the station. Horses were forced to stand hitched for hours, awaiting the arrival of a belated train. There was no way of learning when a train would arrive, unless someone went to the station.

Captain Lundeen sensed the need for a communication system and, with the aid of his friends, installed a simple and inexpensive "telephone" system—an acoustic system—the equipment consisting of two tin cans and a length of wire, as previously mentioned. The wire was stretched over the tops of buildings and through the trees.

Thereafter, when anyone wished to learn the time of arrival of any of the trains which passed through York, he stopped at the office of Captain Lundeen "up town." The latter obligingly signaled the agent at the railroad depot by rattling a large nail or piece of metal upon the tin can mounted upon one of the walls of his office and secured the desired information.

In bad weather static electricity oftentimes disrupted the service, but the improvised telephone line performed many a useful service to residents of York, Neb., who are now—and have been for years—furnished with telephone service of a high order by the Lincoln Telephone & Telegraph Co.

Principles of Successful Management

HIGH TRIBUTE paid to three recently retired executives of Lincoln Telephone & Telegraph Co., who were guests of honor at dinner served at Hotel Cornhusker in Lincoln. Company's early history and policies of management responsible for its success outlined in extemporaneous addresses by President Frank H. Woods and Former Manager L. E. Hurtz. Gifts presented to honored guests in commemoration of their long and valued services with the company

THREE recently-retired executives of the Lincoln Telephone & Telegraph Co. were guests of honor at a dinner tendered them by the company at the Hotel Cornhusker in Lincoln, Neb., in late September. They were W. E. Bell, former general commercial superintendent; C. P. Russell, former secretary-treasurer, and H. W. Wheeler, former general construction superintendent.

Each was the recipient of words of high appreciation for their past services and loyalty to company interests, and each was presented by President Frank H. Woods with a silver service set, as well as a leather-bound scroll setting forth his company history and the appreciation of its officers for past services. A unique feature of the occasion was the tribute paid to "Dad" by Dr. Ralph Russell, son of the retiring treasurer, who told, in dramatic fashion, of the early lessons of honesty and conduct taught him by his father, now fully appreciated.

General Manager John H. Agee presided, and the principal off-hand speeches were delivered by L. E. Hurtz, former general manager, and President Woods.

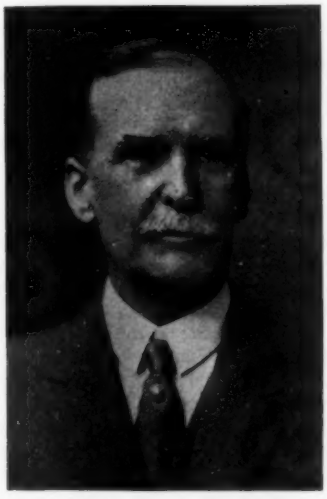
Mr. Hurtz was city electrician at the time that the Lincoln company was organized in 1904, and Mr. Woods said that his attention was challenged to Mr. Hurtz by his fairness and ability shown in a dispute with the city over the routing of pole lines. Following that was his subsequent recommendation that Mr. Hurtz be placed at the head of the staff organization.

Mr. Hurtz said that he came to the company in 1906, two years after the first start in giving service had been made. The company had 2,000 stations at the time, but as cable construction was then in its infancy, most of the aerials were open wire, and troubles were numerous. The company had entered the local field in Lincoln in competition with the old Nebraska Telephone Co., a Bell organization, and while it had the advantage of greater popularity with the people, the competition was fierce.

The equipment installed by the Lincoln company was one of the first put out by the automatic manufacturers. Its newness and the unfamiliarity with it of workmen, and the fact that it was in an experimental stage, made management problems many and called for a lot of night work. Finances were also bothersome; at times it was necessary, in order to meet the bond interest to apportion bonds to be tak-

THREE RETIRING TELEPHONE EMPLOYES HONORED

H. W. WHEELER, of Lincoln, Neb., Who Recently Retired as General Construction Superintendent of the Lincoln Telephone & Telegraph Co. He Entered the Field in 1889.



C. P. RUSSELL Recently Retired as Secretary-Treasurer of the Lincoln (Neb.) Telephone & Telegraph Co. with More Than 30 Years' Service in the Telephone Field.

W. E. BELL, Who Has Retired as General Commercial Superintendent of the Lincoln (Neb.) Telephone & Telegraph Co., First Joined the Telephone Ranks December 1, 1902.

en by the directors then and there.

Later came an era of consolidation, said Mr. Hurtz. The first step was the merger of the exchange company with the Western Long Distance company, organized by men interested in the Lincoln company. It had constructed piecemeal lines and by virtue of connections with other Independent companies

JOHN H. AGEE, General Manager of the Lincoln (Neb.) Telephone & Telegraph Co., Who Presided at Dinner Given in Honor of Three Retiring Employes: H. W. Wheeler, C. P. Russell and W. E. Bell.

had been able to offer toll service to Kansas City.

The service was bad. Each company, in order that no revenue calls got past it, required that its exchange be rung and a ticket made. The calls usually got through, if the persons involved did not die of old age or grow impatient and leave. George K. Gann joined the company about this time as traffic superintendent. Although he is now high in the councils of another company, his services were invaluable in the building up of business in those years.

Consolidation of telephone properties in the state took the form of acquisition by the Lincoln company of operating companies in various parts of eastern and south central Nebraska. Mr. Hurtz said this began with the York company, followed by a number of others, including exchanges at Grand Island and Fremont, north of the Platte river.

Later, this took the form, following negotiations between Mr. Woods and Theodore N. Vail, of a sale of the properties north of the Platte to the Bell company and the taking over by the Lincoln company of the South Platte properties of the Bell.

In pursuance of its policy of never selling stock except for par, the company, after it drew a check for 2¼ millions to pay for these properties, received it back in payment of stock that the Bell company, for a number of years thereafter, held in the Lincoln company. The transaction took place all in one day, he said, in order that the bank balance might not be disturbed.

The company thus found itself with 60 or 70 exchanges, at each of which were two sets of equipment and of everything else; and it required careful management to make use of every available bit of salvage. This made necessary an increase in rates at each exchange, and the subsequent rate cases were sympathetically handled by the newly-organized state railway commission.

A number of the smaller telephone exchanges were purchased at from $10 to $20 a station, and they were put on the books at that figure. This was at a time when quite different practices were in vogue, but there were no rakeoffs and no side profits to anyone. Mr. Woods could have made a million dollars in that way, but he didn't do it.

The success of the company is due to his example and the efforts he made to make of it the high type of corporation that it has been and is. The reason why the company gives service at lower rates than other companies in the country of comparable size is due to the fact that much of the property was acquired at a low cost.

President Frank H. Woods, in making the presentations to the guests of honor, took occasion to still further speak of the company's early history and the policies that have controlled its operation from the beginning. He said he was proud of the company—and had every reason to be—but entirely too much credit was being given to him. Its success is due to the work of the organization, past and present, including the guests of honor who have been numbered among the wheelhorses and the backbone, and all of its employes, loyal and active.

Mr. Woods said that from the start he planned to make the company an ideal public utility—one not operated primarily for profit, but to render a public service. At the time it was organized the city was supplied with a service that was very expensive, more so than many persons could afford. It was not up to date, and the facilities were inadequate.

"Our competitor made it interesting for us," said he. "One of the criticisms was that we had watered our stock because in placing our bonds we had issued a small amount of bonus stock. At the first opportunity, which was when we completed the present organization, we squeezed every bit of water out of it. Today there is not a dollar of stock outstanding that was sold by the company for less than 100 cents on the dollar, and not a single piece of property upon the books at other than what it cost. We are entitled to credit for some foresight. We got away from high financing before that form of business became an object of public condemnation.

"The Lincoln company gave to the city, when it began in 1904, the most modern equipment, and it was a pioneer in the field of automatic telephony. It was one of the first three cities in the country to install this type. Our competitors said that it would not work, and that our investors would lose their money. But we stayed with it, and have

L. E. HURTZ, Former General Manager of the Lincoln (Neb.) T. & T. Co., Who Delivered an Impromptu Speech at Dinner Given in Honor of Three Retiring Employes.

lived to see automatic equipment adopted as standard systems all over the world.

"You will find automatic equipment in use in London, in Berlin, in Paris, also in China. We have lived to see the Bell company adopt it, and to pay to the Automatic company two million dollars for a license. A part of that transaction was the right to use of its patents

and to exchange licenses. Since then the Bell company has paid the automatic manufacturers more than 150 million dollars for equipment."

"We were also pioneers," Mr. Wood continued, "in advocating the regulation of public utilities—and we have lived to see regulation adopted by the nation and by every state. It is the best thing that happened to them.

"We were the first to recognize that dual systems of telephones were inconvenient and expensive, and the service incomplete. We advocated their elimination. Although the work was accompanied by many disappointments, Mr. Vail and his associates were finally brought around to our way of thinking. After we had agreed on principle, it was only a matter of time until the situation was relieved in most of the cities of the United States.

"We also began with the policy of saving every honest dollar we could so as to reasonably reward the investor without robbing the public.

"We were the first to adopt the policy of no free service to any person, and every officer has paid for his service on the same basis as every subscriber. This was breaking new ground because at that time it was a common practice for utilities to issue franks and passes. This is now prohibited by law in Nebraska; but it was a principle we adopted long before public sentiment caught up and compelled its application.

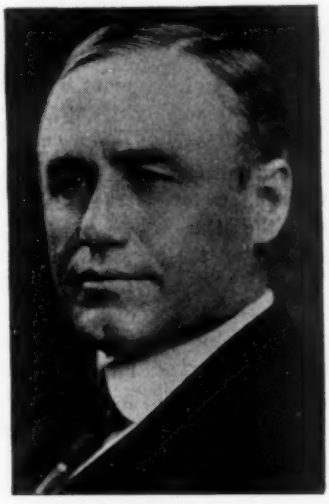
"Much has been heard about national security, and Congress recently enacted into law principles the application of which this company anticipated by ten years, in the matter of pensions and unemployment payments. The company now pays a larger pension than this law requires, but it may be necessary to fight in order to keep it from being wiped out and that of the govment substituted.

"We adopted long ago what the law has since compelled. We have not been able to fully compensate our employes, and only a small portion of the salary cuts of a few years have yet been restored.

"During all these years we have paid all dividends, except to holders of a special class of stock which was created when it was necessary to organize a holding company to keep control from possibly slipping into the hands of promoters then operating in the field.

"We organized the Lincoln Telephone Securities Co., after refusing all offers made to us to sell. In this way we were able to tie up control in the hands of a group of officials who could be trusted. They are the only ones who have not been paid dividends in the last few years. They are not complaining. The depression will blow over, and they will get what is their due.

"We have been proud to serve the public, and we have every reason to believe the public is glad to have us serve it. It is as good a company as anywhere in the world. It is giving just as good service, and at rates lower than other like companies. There has been no intent or purpose to make money; and if there is to be any monument to us, let it be the company, the way in which it was run and the results accomplished.



PRESIDENT FRANK H. WOODS, of the Lincoln Company, Presented Honor Trophies to Three Retiring Employes at Dinner Given for Them Recently.

"This could not have been done without the men in the organization who have fought its battles; in the early days Mr. Hurtz was a tower of strength. Without the men honored this evening we would not have done as well as we have done. It is not material things which give men the best satisfactions; those are to be found in rendering useful service to their fellow-men."

In his remarks Mr. Russell related other details of early struggles, suggesting that one of the wisest moves was to encourage thrift and industry among employes, since the money from sales of stock to them carried the company over several obstacles.

Mr. Bell and Mr. Wheeler contributed to the symposium on early-day history, and brief remarks were made by Railway Commissioners Maupin, Drake and Bollen. Mr. Maupin said that the history of the company's treatment of its employes was a refutation of the old claim that a corporation has no soul.

H. W. Wheeler began his career in the communication field August 1, 1889. As a young man he was employed as a clerk in the corner grocery store at Schuyler, Neb. The news of "Men Wanted for Work—Apply at the Western Union Office," reached his ears, and he walked out from behind the counter and joined the ranks of the Western Union Telegraph Co. He started as a groundman at Brookville, Kans. His experiences for the next eight years were varied and interesting, and he had an important part in the building of many of the first telegraph lines in that section of Kansas.

All of Mr. Wheeler's service in the telephone industry has been in Nebraska. After leaving the Western Union his first telephone job was held in 1897, when he joined the ranks of the Nebraska Telephone Co. as a lineman at Omaha. In 1899 he was made foreman, and in 1901 he was transferred to Holdrege as district manager, with complete supervision of all plant activities in western Nebraska, a territory comprising 54 towns (having only a telephone booth) and eight exchanges (like those today).

On August 1, 1909, he was named district foreman of the Hastings district, and one year later he was promoted to district plant chief. On May 1, 1929, he was promoted to the position of general construction superintendent, with headquarters at Lincoln, the position he has held continuously until his retirement on August 5.

W. E. Bell began his telephone career on December 1, 1902, at York, Neb., as one of the organizers of the York County Telephone Co., holding the positions of secretary and general manager. Later Mr. Bell was one of the organizers of a toll line company which bought several exchanges and extended its area of service.

In 1912 the property was purchased by the Lincoln Telephone & Telegraph Co., and Mr. Bell became commercial manager for the northern district with headquarters in York. The following year he moved to Lincoln to assume the duties as commercial manager of the Lincoln district, and in 1921 he was made

(*Concluded on page* 17)

A State Planning Board's Survey Of Telephone Communication

TELEPHONE RATES and quality of service go hand in hand. That is a statement which has been made many times by executives of the national and of the various state telephone associations—and it has also been emphasized repeatedly by TELEPHONY. In a territory where rates are low, it will generally be found that the telephone plant is not adequately maintained, the service is poor and the company is not known as a successful one.

These conditions are again brought to the attention of the telephone industry—not by telephone men, but by disinterested investigators who have studied the situation from the viewpoint of the best interests of the public.

One of the projects of the Iowa State Planning Board was the study of the actual existing conditions in telephone communication in Iowa. The unabridged report of the public service division of this government organization, together with a summary of the report which was submitted by the board to the National Resources Board in Washington, D. C., was published in TELEPHONY of November 2. It is worthy of careful study and consideration by all telephone managers, especially those operating in small towns and rural communities.

THE REPORT confirms everything that has been said by experienced telephone men concerning some of the smaller companies and the mutual systems in the rural districts. "Almost all the mutually-owned—and a few of the small, privately-owned—telephone companies' lines and exchanges are in very poor condition and near the end of their service life," it states. "Many miles of lines are so corroded that splicing of broken wire is almost impossible. Few splices were ever soldered.

"Many poles are decayed, some are propped up, and some are hanging or lying flat. Through timbered areas, wire is ingrown into trees. Switchboards antedate the recollection of present operators; repairs, in many cases, are made by the local blacksmith, or by the clumsy proddings or twistings of one of the operators, untrained in the use of tools."

Had these plants and systems been properly maintained in the years before the depression, their condition and service now would have been considerably better. Of the larger Independent companies and of the Bell company which had their plants in good condition before the depression and which have kept their rates up since, the report continues: "The Bell System and the larger Independent telephone companies are maintaining their systems in fine condition.

"With many switchboards and much physical equipment worn out and obsolete, there can be no question about the need for rebuilding. The managers of many companies have stated that they would like to replace poles, wire, cable, switchboards and other items, if they had the money. There is much to be done, and there will be a large market for all types of telephone equipment when economic conditions improve."

THAT SIMILAR CONDITIONS in the smaller companies and rural systems may also be found in other states, is evident from the comments of a telephone man located in a state some thousand miles from Iowa, made following a trip through a nearby state. "All of the smaller telephone exchanges throughout the central part of the state," he writes in a recent letter to TELEPHONY, "must have been hard-hit—brackets are off, insulators missing, poles rotted off at the butts and swinging in the wind, frayed drop wire, tree limbs in the lines.

"How they can expect to retain the present subscribers, or regain lost ones, with badly run-down outside plants is more than I can see. Some of the exchanges in the state have been let run-down so badly, that, to me, the only way to put them in shape for real commercial telephone service would be a complete rebuilding job."

Although the foregoing comments apply to states located some 1,500 miles apart, they might well be said to refer to the same territory. Undoubtedly much of the same comments applies also to telephone communication in the rural communities in other states.

The matter of free service to other exchanges is discussed in the report of the Iowa State Planning Board as really amounting to toll service. "If the circuits were made metallic and the lines and equipment maintained in first-class condition," says the report, "charges could be made which would aid the companies in maintaining their systems."

"The only way that this 'free service' can be eliminated," it is suggested, "is through cooperative action of all companies in the association—and even then a few customers will be lost."

CONSIDERING the matter of service rates and costs, it is stated that very few of the mutual telephone systems use even a semblance of method in determining rates. "Rather they have reduced rates without regard for maintenance expense, to the end that the condition of equipment precludes the possibility of rendering adequate service.

"The 'service-below-cost' rates charged by so many small systems have caused the rates charged by well-maintained systems to appear excessive. . . . We criti-

cize the lack of maintenance, but why should one keep putting money into a losing investment? The lowest rates are considered the fairest rates; if the private owner demands a higher rate than that paid by neighboring mutual groups, the subscriber strenuously objects."

"Our survey shows," the report states, "that rates vary between $4.50 and $24.00 a year, with $12.00 a year being the most common. Reports indicate that collections of $4.50 are almost as difficult to make as the higher ones."

IN SUMMARIZING the situation of telephone communication in Iowa, the report states that the decrepit condition of the small Independent and mutual exchanges in the state is due to a number of factors which the managements have failed to recognize and for which no provisions have been made.

It is stated that these companies have neglected to correctly account for all service costs, particularly depreciation. In the past quite generally they have charged for service at the "below-cost" rates. The investment has been dissipated in the form of "low rates."

"The companies have lost sight of the original investment and have not made allowance for depreciation. The original system and equipment are worn out, and no funds have been set aside to cover the cost of replacing them." In most cases, it is stated, these companies have kept no accounts and have not rendered annual financial statements. "In some cases employes have not received, and are not now receiving, sufficient wages," continues the report.

"Making suggestions to rectify the present situation is like locking the barn door after the horse has been stolen," the summary concludes. "We consider telephone service necessary and worthwhile, but recognize the fact that some definite changes must be made to render it financially sound in rural communities."

IT IS CLEARLY indicated in this report of the Iowa State Planning Board that a reorganization of the rate system is needed. The telephone plants should be rebuilt and depreciation allowances made to maintain the systems. "Much education," it is stated, "will be required to make the public appreciate the justice of higher rates; some persons will refuse to pay, but in justice to the others they will have to get along without service. It will be difficult to obtain funds for rebuilding and, for a time, to collect higher rates; but as conditions are adjusted and management improved, it should be easier."

While the smaller Independent companies and the mutual systems and rural lines are severely criticized in this report, the remedy is also clearly indicated—rates and service go together; adequate rates are essential for good telephone service. Telephone service is necessary in rural communities and not enough money, in the form of rates or assessments, is being spent for it by users to properly maintain the lines and systems.

"The Iowa small town," says the report, "will continue to exist and thrive as a *service* center for its community. . . . There is reason also for predicting that the small town may resume much of its old importance as a community center for recreation, education and religious activities."

These constructive criticisms, coming from a body having no connection with the telephone industry—and no interest in it, except for assuring the public good and continuous service—should be given serious and thoughtful consideration. Now is the time for the management of telephone companies to "think ahead" as to what they must do in the next few years as economic and business conditions improve, as they surely will.

PRINCIPLES OF SUCCESSFUL MANAGEMENT

(*Concluded from Page* 15)

general commercial superintendent in charge of all commercial activities.

On January 16, 1934, Mr. Bell was named vice-president of the company, the position he held at the time of his retirement from active service. Mr. Bell has always been active in telephone organizations. Prominent among them is the Nebraska Telephone Association which he helped to organize. He has been its president twice, is a member of the board of directors and has been treasurer for many years. He is also a member of the Telephone Pioneers of America, Casper E. Yost chapter.

February 1, 1905, marked the beginning of C. P. Russell's telephone career. His first duties embraced assisting a telephone accountant from Toledo, Ohio, to install a uniform system of accounting for the Lincoln Telephone Co. which had been organized in January, 1904.

On September 16, of the same year, Mr. Russell was permanently employed, and F. E. Ebersole, then general manager of the company, selected Mr. Russell to take charge of general office activities. This assignment included the duties of company auditor, business office manager and the handling of the company payroll.

In 1906 the Lincoln Telephone Co. and the Western Telephone Co. merged and Mr. Russell continued as general accountant, serving in this capacity until 1912, when he was promoted to the position of general auditor. In 1918 Mr. Russell succeeded Seth W. Eddy and A. L. Haecker as secretary and treasurer, respectively, of the company, the position he held when he retired from active service.

Mr. Russell is a member of the Telephone Pioneers of America, Casper E. Yost chapter.

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Telephones on Europe's Highest Mountain

Claimed to be the world's highest telephone, an instrument was recently installed at the top of Mt. Elbrus in the Caucasus. It is the highest peak in Europe, being 18,465 ft. above the sea level.

The top telephone of the system of 65 miles of line, which links the camps and inns on Mt. Elbrus, is at an elevation of 18,368. The system establishes connection with central cities of Soviet Russia. Some of the poles were carried up the mountain on men's shoulders.

The Operators' Corner

By MAYME WORKMAN

Traffic Supervisor, The Illinois Telephone Association, Springfield, Ill.

QUESTIONS and answers appearing in this department regularly, are contributed by Illinois operators who attend traffic schools at district meetings and state conventions held by the Illinois Telephone Association. No. 217

NEXT WEEK an "Operators' School of Instruction" will be conducted at the 31st annual convention of The Illinois Telephone Association at Hotel Pere Marquette in Peoria on November 14 and 15. One of the highlights of this meeting will be a round table discussion of traffic problems. Every girl who plans to attend this session is urged to bring one or more written questions.

May the writer suggest that you do not wait until your arrival in Peoria to write your question? Do so *now*. It is more difficult to concentrate with others around and very often ideas are elusive.

By bringing your questions to this conference you will not only solve your own problems but will contribute to the value and success of this session by aiding your co-workers. The more questions we have to propound the greater the benefits we will derive.

Perhaps at this time it is well to recall that the questions submitted by traffic employes at district meeting and state convention traffic schools, conducted by The Illinois Telephone Association, make "The Operators' Corner" possible. It records the problems of Illinois operators throughout the state.

At the present time a number of important revisions and changes are being effected and introduced in toll operating practices. You may have some questions in connection with these changes. Make a note of them now so that you may have your questions answered by authorities on these subjects.

Your questions, as well as other questions submitted at the convention, together with their answers, will appear in TELEPHONY at some future date, to be read, not only by yourself and other telephone folk in Illinois, but by operators, supervisors, chief operators and managers in other states and foreign countries as TELEPHONY, like the human voice, reaches the four corners of the earth. Your question may be read by an operator in New Zealand or a manager in Canada and may be helpful in solving their problems too.

Bring as many questions as you like. There is no limit. Come and enjoy the surprise features that await you for your entertainment and development. Your correspondent will be happy to meet you and to greet you in Peoria.

Questions from Illinois Operators

1. When a subscriber places a call by address name, are we permitted to ask under what name the telephone is listed?
2. If a tributary has a ticket and toll center has passed it, who should time it; toll center alone?
3. Should a toll center operator be responsible for all reports she has for her tributary office? I mean by this, is the toll center operator supposed to give reports to the tributary office subscriber?
4. If a subscriber calls for a number several times and the line is busy, should you call him when the line isn't busy if he doesn't suggest it?
5. When do we refer a "BY" or "DA" to the TTC supervisor?

The answers to these traffic questions are given on page 24.

HABITS

By MISS ANNE BARNES

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa

HABITS, GOOD OR BAD, are more lasting when formed in early life. We are prone to follow our *impulses*, then, rather than to be guided by *reason* and either may some day rule our lives. We often complain against fate, but we shouldn't because we do more to shape our destinies than fate could ever do.

We choose our friends and associates, except those in our business, and are often influenced by their mode of living to quite an extent. We take up their ways because, if we do not, we feel like misfits in their company and this does not make us any happier than it does them.

Habits of thinking and doing, that are different from those of our friends and associates, are often the cause of misunderstandings and clashes. When things come to a show-down, we find ourselves giving-in to our habits of desire, or of least resistance, rather than do what reason tells us is the better way. This does not mean we are weaklings with no will of our own, but rather that we are peace-loving. We like to get along with people.

No doubt, one reason why telephone companies prefer applicants between the ages of 18 and 22 for traffic work is because young people under the age of 18 are largely creatures of *impulse*, and after 22 they are prone to become creatures of *habit*. After habits are once *formed*, time *sets* them. If they are good habits, all is well, but if they are bad, so much the worse for managers and chief operators who have to direct the work of such employes.

"How use doth breed a habit in a man," said Shakespeare. In time, habit does one of two things: It becomes our *servant* or our *master*.

We have to think hard and fast and wisely, to keep up with the ever-changing conditions under which we are living. Good habits of thinking, deciding, and doing, will help us to keep moving with the times, while poor ones such as habits of imitating the Joneses will shove us into the discard.

MORAL: "The chains of habit are generally too small to be felt until they are too strong to be broken."—Johnson.

"Kid" Drivers Are Dangerous

By JAKE THE LINEMAN

MORNIN' BUDDIES! Some weeks ago I stated that figures proved that women drivers had the edge on men drivers when it came to perambulating the old gas buggy over the streets and highways without having an accident. Many of you buddies told me that after *that* statement, your wives really put on the "know-it-all" air when it came to driving or supervising the driving.

Wa'll, today I've got a bunch of figures for you which may cause "Junior" to make heart-rending pleas before you allow him to have the family chariot for his next big date. The chart shown on this page is based upon the findings of The Travelers Insurance Co., and brings out the percentage of change in the rates of death by automobile accidents from 1922 to 1933, inclusive.

During this period when the rate of death was increasing 81 per cent for all ages combined, there was a decrease of 5 per cent in the age group of 5 to 9 years and in the next age group of 10 to 14 the increase was only 3 per cent. Undoubtedly, the great improvement in the fatal accidents experienced in the age group of 5 to 9 years and the very small percentage gain in the next age group of 10 to 14 years, have been the result of safety education in the schools and the protection furnished by traffic officers in the vicinity of the schools.

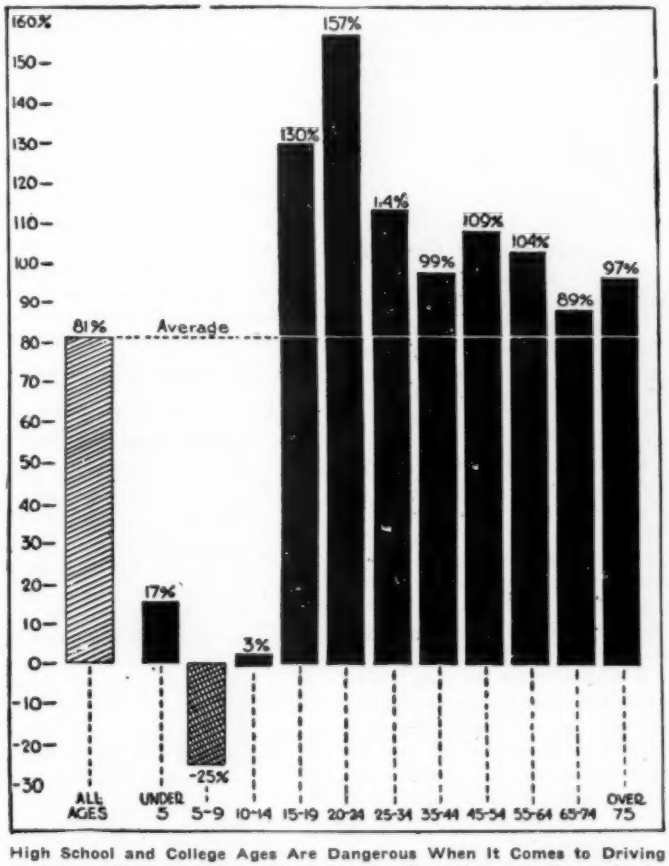
But—in the age group of 15 to 19 years, which may be regarded as the high school period, deaths from automobile accidents increased 130 per cent; while in the age group of 20 to 24, the college age, the increase was 157 per cent! The record of deaths in these two age groups point to the great need of educational effort at the time when young people are beginning to drive cars.

In 1931 drivers under the age of 18 were involved in 26,410 accidents in which 1,270 persons were killed and 25,140 were injured. In the same year, drivers in the age group of 18 to 24 had 326,940 accidents in which 13,000 persons were killed and 326,940 were injured. In 1932, drivers under the age of 18 (probably feeling the effect of the depression on Dad's income) had only 11,960 accidents in which 740 were killed and 11,220 were injured. In the same year drivers in the age group of 18 to 24 years (probably suffering from the same effect) had only 245,890 accidents in which 8990 were killed and 236,900 were injured.

In the year of 1935, Dad's income must have picked up a little because drivers under the age of 18 had 15,050 accidents which killed 830 persons and injured 14,220. In the same year drivers in the age group of 18 to 24 years managed to have 245,360 accidents which took the lives of 10,160 and injured 235,200.

In 1934, Dad's income must have jumped up to nearly normal for drivers under the age of 18 did more driving and, as a result, had 16,980 accidents which killed 980 persons and injured 15,910. Drivers in the age group of 18 to 24 years also noticed the "upping" of Dad's income and proceeded to "up" their own auto accident record by having 286,940 accidents, killing 12,800 persons and injuring 274,140.

The figures just given are not to be glanced over and then forgotten. They show that young drivers are doing their part to boost America's high auto accident records. Many high schools are providing driving courses and as these are extended to all high schools, as they should be, the experience in the high school and college group will begin to show the improvement that must be made if future generations of drivers are to become safer drivers than many present-day motorists.



High School and College Ages Are Dangerous When It Comes to Driving an Automobile, According to Chart Showing Percentages of Change in the Rates of Deaths by Automobile Accidents from 1922 to 1933, Inclusive.

We telephone buddies, with sons and daughters who get a kick out of driving, can do much to help reduce the auto-accident record by showing our offspring how to drive safely and warning them of the dangers of careless driving.

Wa'll, I guess I'd better get goin' 'fore I have Junior on my neck. Until I see you again remember: "The roads and the highways of America will never be safe until their greatest hazard, *the careless driver*, is removed and put away for keeps."

Activities of Commissions and Courts

FCC to Publish Compensation of Company Officials

The Federal Communications Commission at a general session on October 30 authorized its accounting, statistical and tariff department to compile and release a statement, as soon as possible, showing the compensation of officers, directors and other persons connected with large communications companies for the year 1934, who receive $10,000 or more during a given year.

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Rehearing on Coaxial Cable Order Granted

At a general session of the Federal Communications Commission on October 30 it was decided to reopen the application of the American Telephone & Telegraph Co. for permission to construct an experimental coaxial cable from New York to Philadelphia for broad band transmission.

This action followed a petition of the American Telephone & Telegraph Co. asking permission for "reargument" of the recent order of the commission (July 24) granting permission for the construction of the cable under certain conditions.

The commission not only granted the request of the applicant but decided to permit a rehearing of the case before the entire commission at the earliest practical date open on the commission's docket. This is November 25, and the hearing will begin at 10 a. m. at the commission's offices in Washington, D. C.

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U. S. Supreme Court Reaffirms Maryland Ruling

For the second time in four months the United States Supreme Court on October 14 ruled against the Maryland Public Service Commission in its fight to secure lower telephone rates for Baltimore and vicinity. In an opinion handed down by Justice Owen J. Roberts, the court refused to reconsider its decision of June 3 which nullified the commission's order for the Chesapeake & Potomac Telephone Co. to reduce its annual net income by not less than $850,000.

The method of using commodity indice prices in determining the value of the company's properties was improper, according to Justice Roberts' decision.

After the commission had entered its order in November, 1933, the company obtained a restraining order from the United States District Court, and it was from this decision that the commission took an appeal to the United States Supreme Court. After the latter had upheld the injunction in its decision of last June, a petition was filed for a reargument, which was refused in the decision on October 12.

Although the commission is restrained from trying to enforce its order, it is possible that proceedings may be started anew, with another hearing before the commission.

"The question is still open," said Harold E. West, former chairman of the commission and now its chief adviser, "as to the reasonableness of the amount of the reduction ordered. The supreme court held that the method by which this amount was determined was faulty, and concluded that the result was improper.

"It may be that the district court will return a mandate directing a new hearing before the commission, with different methods to be followed in determining the amount of income reduction," he said.

The petition for reargument was filed by Richard F. Cleveland, before he was succeeded as general counsel for the commission by J. Purdon Wright.

The company had set aside a fund, which in its last financial report amounted to $1,544,200, to take care of possible refunds in case the supreme court's decision had been in favor of the commission's order.

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Detroit, Mich., Asks 2½-Million-Dollar Rate Cut

In a brief filed with the Michigan Public Utilities Commission on October 15, the city of Detroit asked that $2,500,000 annually be lopped off the income of the Michigan Bell Telephone Co. in the Detroit area. Assistant Corporation Counsel Arthur F. Lederle filed the request in the present telephone rate case, in which the company is seeking to increase its rates.

Under the proposal, residential service would be not more than $1.60 per month for 40 calls. Counsel Lederle charged that the testimony now before the commission in the Michigan Bell case shows the Detroit area yields a return to the company eight times that of other Michigan exchanges. He declared that the commission should adjust rates and that a reduction should be ordered which would give the utility not more than 5½ per cent return. The commission in previous rate cases has accepted 6 per cent as a fair return on utility investments.

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Motion to Set Aside Summons Overruled

On October 12, The Northern Indiana Telephone Co. of North Manchester, won the first round in its action against the Indiana Public Service Commission and the Urbana Telephone Co. to set aside an order of the state commission when Judge B. C. Kennedy overruled a motion by the defendants to set aside a summons for the commission and also overruled a demurrer to the second paragraph as filed by the Urbana Telephone Co.

The public service commission a few months ago issued an order instructing the North Manchester company to remove certain subscribers from its lines between Urbana and North Manchester

Answers to the Traffic Questions on Page 18

1. When a subscriber places a call by address name it is usually assumed that the telephone is listed under the name given. However, if the calling party indicates that the telephone is not listed under the name given, the operator is permitted to ask under what name the telephone is listed.
2. If the tributary operator records a ticket and passes this ticket to her toll center for handling, the toll center will time the call.
3. The toll center is responsible for passing reports to either the tributary subscriber or the tributary operator in accordance with the method in effect for handling the tributary's toll traffic.
4. It is not considered advisable to do so, for several reasons, one of which is that it might establish a precedent resulting in complications due to the fact that all customers are entitled to the same service.
5. On an "emergency" call when a report of "BY" or "DA" is received.

and permit the Urbana company to furnish them telephone service.

The Northern Indiana company objected to the order and asked a rehearing which was denied. It then filed suit against the commission. In the suit the defendant was named as "The Public Service Commission of Indiana." In acting to have the summons set aside, attorneys for the commission used the technical point that the "Public Service Commission of Indiana" was abolished by the 1933 state legislature and that it is now the "Public Service Commission."

The court held that the commission was the same and had the same power as the old one, even though the words "of Indiana" have been stricken from the official title. Such change would not invalidate the summons issued against the commission and its members, the court held.

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Court Hearing Opens in North Carolina Case

The de novo hearing of the North Carolina rate case of the Southern Bell Telephone & Telegraph Co. opened October 28 before Judge G. Vernon Cowper, in Wake County Superior Court, Raleigh, N. C. A jury of 12 men was selected to hear the case, which is the outgrowth of an order issued last December by the North Carolina Utilities Commission reducing the rates of the Southern Bell company about 12 per cent or more than $300,000 annually. The jury was dismissed the following day, by mutual agreement of counsel for both sides.

The telephone company was successful in securing a writ of supersedeas, staying the effectiveness of the December order, and posted bond of $300,000 to protect subscribers as of January 1, 1935, the date the cuts were ordered to go into effect.

Most of the October 28 hearing was given over to selecting the jurors to hear the present court case. The only evidence adduced was through R. O. Self, chief clerk of the commission, who identified the rate reduction order issued by the commission last December. Judge Cowper ruled that the burden of overthrowing the commission's reduction order rests on the telephone company.

With the opening of the October 30 session, Judge Cowper promptly overruled a motion of the telephone company counsel to set aside the rate reduction order. Later in the day, after lengthy arguments, authority was also denied the Southern Bell to submit in evidence the record of the hearing before the commission last year which preceded issuance of the rate reduction order. The defense entered exceptions to both rulings of Judge Cowper.

In sustaining the commission's objection to the admission of the record, Judge Cowper held that if he accepted this data as evidence and used it in determining the degree of arbitrariness of the rate order, he merely would be reviewing the action of the commission rather than giving both parties an entirely de novo trial.

"Should I, after examining this record, come to the conclusion that the order is arbitrary in nature, I would then stop the trial, without having given the plaintiff the de novo trial guaranteed by our law," Judge Cowper said. "The only possible basis on which I could rest such an action would be the belief that our entire procedure in these matters is violative of the United States Constitution."

The decision refusing to dismiss the proceedings, the equivalent of a non-suit judgment, followed consideration of the matter overnight by the judge. Arguments on this phase were heard Tuesday, October 29, after a jury drawn to hear the case had been dismissed upon agreement of counsel for both sides, leaving it up to Judge Cowper to find facts in the matter.

At the October 31 session, counsel for the Southern Bell indicated that the company will base its revised attack on two main points: (1) It will attempt to prove the commission's method of determining depreciation of the physical property of the company in intrastate use in North Carolina is unsound and that the method employed by the company should have been used. (2) It will attempt to show that the commission's deduction of 20 per cent of the calculated value of the property, "due to general price declines," was erroneous and should not be allowed to stand in support of the order.

The company's first witness, L. W. Hill, of Atlanta, testified the physical

W. L. CARY PASSES AWAY

WILLIAM L. CARY, president of the Newark (Ohio) Telephone Co. and vice-president and director of the Ohio Independent Telephone Association — a veteran of 35 years' experience in the Independent telephone business in the Buckeye state—passed away October 28 at the age of 72 years. Mr. Cary had been suffering from heart disease for three weeks prior to his death, which occurred in his home in Columbus.

He first became identified with the Independent telephone industry in 1901 as counsel for the old Cuyahoga Telephone Co. He had previously practiced law in Mt. Vernon for three years, after graduating from the law school of the University of Cincinnati in 1888.

When the Cuyahoga Telephone Co. was consolidated with the Ohio State Telephone Co. in the spring of 1914, Mr. Cary became vice-president, secretary and counsel of the new corporation. With a capitalization of more than $23,000,000, the Ohio State company took over and consolidated the properties of 15 Independent telephone companies in which J. P. Morgan & Co. had secured substantial holdings.

Mr. Cary continued to serve as secretary of the Ohio State Telephone Co. until 1921 when it was taken over and merged with the properties of the Ohio Bell Telephone Co. Since that time Mr. Cary served as president of the Newark Telephone Co. The stable financial condition of that company is testimony to his ability as its directing head.

W. L. CARY, Late President of Newark Telephone Co., Newark, Ohio, Was Identified With Independent Telephony in Ohio for Some 35 Years

For years Mr. Cary had been active in the work of the Ohio Independent Telephone Association, serving as director and as vice-president since 1931. His passing is mourned by a host of friends in national as well as state telephone circles, who greatly admired and respected him.

Mr. Cary is survived by two daughters and one son, his wife having passed away only last May. His body was interred in Bird cemetery in Mt. Vernon.

value of the company's North Carolina property in intrastate use was $16,727,800 on December 31, 1932, and that the reproduction cost of the same property would have been $17,882,500 if bought new, including going concern value and working capital but less the present depreciation. Much of Mr. Hill's testimony was technical.

Direct examination of Mr. Hill was not completed at the November 1 session. He devoted most of his testimony to an explanation of his methods for determining depreciation of the company's physical property in intrastate use. Adjournment was taken until Monday, November 4. It was indicated that three weeks may not be sufficient time for completion of the hearing of the Southern Bell against the reduced rates and that additional time or another special term of Wake County Superior Court may be required.

• • •

Rebuttal Testimony in Wisconsin Rate Case

With a difference of $24,000,000 in the "on paper" valuation of the property of the Wisconsin Telephone Co., after making allowance for depreciation, the major portion of the hearings in the state-wide rate investigation by the Wisconsin Public Service Commission during the last two weeks of October and the first week of November was given over to rebuttal testimony in criticism of opposing depreciation theories and cross-examination of witnesses.

G. W. Cummings, of Chicago, special engineer for the commission, testified on October 23 that if the theory of depreciation expressed by one company engineer is correct, central office equipment in the Madison exchange carried on the books at $450,000 is worth for rate-making purposes only $22,500 or what the scrap would bring if sold to a junk dealer. This testimony immediately was attacked by both Edwin S. Mack and Frederic Sammond, company attorneys of Milwaukee, both as a misunderstanding of what the company engineer testified, and a misapplication of the theory as misunderstood.

Lengthy theoretic argument resulted between the company attorneys and Alvin C. Reis, the commission's chief counsel. Mr. Reis quoted testimony from a previous hearing by W. F. Sloan, Chicago, special engineer of the company, that telephone equipment is out-of-date and of lessened value when the cost of operating it is greater than the cost of operating more modern equipment that could replace it.

Mr. Cummings then proceeded to testify as to several hypothetical calculations he had made in applying this theory. In reply Mr. Mack contended that Mr. Cummings failed in his calculations to take account of the fact that the newer equipment might itself be outmoded by still newer equipment and that Mr. Cummings' calculations would, therefore, be thrown away.

Messrs. Cummings and Reis pointed out that if this fact were not provided for in Mr. Cummings' calculations, neither was it provided for in the company's theory. The Cummings' testimony, it was pointed out, was intended to be in the nature of a rebuttal to testimony by company engineers.

Wisconsin Telephone Co. attorneys, on October 24, unsuccessfully attempted to block testimony of Mr. Cummings on the ground that it was not rebuttal but correction of previous direct testimony.

Commissioners Fred S. Hunt and A. R. McDonald sustained arguments of Alvin C. Reis, the commission's chief counsel, that Mr. Cummings' testimony concerning the company's maintenance expenses constituted proper rebuttal testimony.

Mr. Cummings testified that he had recomputed costs of the company to answer a contention by George F. Crowell, company chief engineer, that 1929 was the most abnormal year in the company's history with regard to maintenance.

The commission used the 1929 wage levels in its calculations, Mr. Cummings said, testifying that 1927 wage levels could be used with little effect on the final result. He pointed out that Mr. Crowell admitted that 1927 was an average year.

Reid Weddell, special engineer for the commission, testified that over a 20-year period the company could save $3,675,486 by using dial telephone equipment manufactured by the Automatic Electric Co., in five Milwaukee exchange dial offices instead of equipment made by the Western Electric Co. Mr. Weddell testified,

Answers to Problems in Fourteenth Article

The answers to the problems, concerning principles of electricity, given in the fourteenth article of this series entitled "Thermionic Vacuum Tubes in Telephony" — published on pages 9 to 12, inclusive, of this issue—are as follows:

52. (a) 0.74 volt.
    (b) Voltage amplification, 7.4.
    Maximum possible amplification, 9.3.
53. 190 volts.

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further, that if the Wisconsin company should install dial equipment all through its Milwaukee exchange, it could save $1,938,987 or 15.9 per cent, as compared with the cost of installing Western Electric dial equipment.

Frederic Sammond, Milwaukee company attorney, sought to have Mr. Weddell's testimony stricken as not relevant to the case but the motion was denied by Commissioners Fred S. Hunt and A. R. McDonald.

Mr. Cummings criticized Mr. Crowell's "on paper" reproduction of the company's plant for valuation purposes. He said Mr. Crowell could have used lower figures in Milwaukee for cost of supervising construction crews. He could have assumed fewer trucks to serve cable crews and, in the case of the cable crews, had assumed a higher cost for supervision of the crews than the company's own experience revealed.

The witness also declared that the time charged for testing and inspecting the dial equipment in five Milwaukee offices was sufficient for dial offices to serve all of Milwaukee. One-third of Milwaukee's telephones are dial-operated.

In rebuttal testimony on October 25, L. T. Hayner, engineer for the commission, testified that the company's valuation of its exchange property overstated four items by the total amount of $6,200,000, that it is $4,088,500 too high on central office, PBX and customer telephone equipment; $132,500 too high on estimates of labor costs on cable line construction; $600,000 too high on exchange pole line construction and $380,000 too high on cost of labor in installing subscribers' telephones.

Interest during construction, estimated by an "on paper" reconstruction of the company's existing plant, is from $1,200,000 to $1,500,000 too high in the company valuation, Mr. Hayner asserted. The witness at a previous session of the hearing had attempted to prove that the company's allowance for depreciation is $6,000,000 higher than is equitable.

Alvin C. Reis, chief counsel for the commission, asserted that the largest item rested upon the determination of which is right—the commission or the company staff—in the choice of typical price levels in evaluating the equipment.

Mr. Reis, in cross-examining George F. Crowell, company chief engineer, on November 1, developed that with the "trial labor units" used in the engineer's "on paper" reproduction of the telephone company's plant, laborers would dig only two shovelfuls of earth every 11 minutes and company trucks would average a speed of only eight miles per hour.

The Crowell valuation of the company's property is about $24,000,000 greater than the valution computed by the commission's staff, after making allowance for depreciation.

The hearing was continued to Thursday, November 7.

• • •

Labor Commission Ruling Not Yet Effective

The Kansas Commission of Labor and Industry held a meeting September 24 to consider whether or not its order of August 29, relating to the hours and working conditions of women and minor telephone operators, should be modified. No decision will be announced until November 20 and, in the meantime, the recent order will not be enforced.

However, the commission proposed to investiagte the working conditions in every telephone exchange so as to have information at hand to determine whether its order should be modified.

• • •

Commission Rulings and Schedule of Hearings

FEDERAL COMMUNICATIONS COMMISSION TELEPHONE DIVISION, WASHINGTON, D. C.

October 29: Authority granted American Telephone & Telegraph Co. to establish charges for overseas telephone service to Santo Domingo, Dominican Republic, effective October 31, on less than statutory notice.

October 30: Petition granted, of the American Telephone & Telegraph Co. for a reargument on its application to construct a coaxial cable between Philadelphia and New York. The hearing will be held November 25.

CALIFORNIA RAILROAD COMMISSION

October 22: Joint application filed by A. A. Harrington and Marie Lentz, for authority respectively to purchase and sell interest in the telephone system in Livingston, Merced County.

October 23: Application filed by Kern Mutual Telephone Co. for authority to open certain toll stations, the extension of the McKittrick exchange area and filing of certain rates.

ILLINOIS COMMERCE COMMISSION

November 6: Hearings in Springfield on proposed changes in rates for telephone service furnished by the Ashland Telephone Co. in Ashland; the Cass County Telephone & Telegraph Co. in Virginia, Cass County; the Elmwood Telephone Exchange in Elmwood; the Home Telephone Co., in St. Jacob, and the Okaw Commercial Telephone Co. in Okawville, Addieville and Venedy.

November 6: Hearing in Springfield on proposed changes in rates of the C. T. & N. Telephone Co. for telephone service applying to all its exchanges, stated in general toll schedule I. C. C. No. 1 original sheet No. 10 and general exchange schedules I. C. C. No. 2 original sheet No. 7, Neoga; I. C. C. No. 2 original sheet No. 5, Casey and I. C. C. No. 1 original sheet No. 5 Toledo, rendered by the company.

November 6: Hearings in Springfield on proposed changes in telephone rates of the Peoples Telephone & Telegraph Co. of Menard County; the Suburban Electric Utilities Co., of Dunlap; the Westfield-Kansas Telephone Co., of West-

field, Kansas, and adjacent rural territory; the Southeast Missouri Telephone Co.; the Illinois Allied Telephone Co.; the Missouri Valley Telephone Co.; the Midland Telephone Co.; the Atwood Mutual Telephone Co.; the Arthur Mutual Telephone Co.; the Illinois Commercial Telephone Co.; and the Minonk (Ill.) Telephone Co.

November 6: Hearings in Springfield on proposed changes in telephone rates of the El Paso (Ill.) Telephone Co.; the Troy (Ill.) Telephone Co.; the Harrisonville Telephone Co.; the LaMotte Co-operative Telephone Co.; the Staunton Telephone Co.; and Findlay Mutual Telephone Co.; the Woodhull Switchboard Association; the Champaign County Telephone Co.; and the Montrose (Ill.) Mutual Telephone Co.

November 6: Hearing in Springfield on proposed change in rates for telephone service applying to all exchanges, stated in supplement No. 1 to general exchange schedule 1 and general toll schedule I. C. C. No. 1 original sheet No. 9 of the National Trail Telephone Co.

NEBRASKA STATE RAILWAY COMMISSION

November 1: Application filed by Lincoln Telephone & Telegraph Co. for authority to cancel two-party residence service no longer offered at its exchanges at Belvidere and Carleton.

November 1: Application filed by Craig Telephone Co. for authority to furnish service to farmers in territory occupied by Northwestern Bell Telephone Co. lines.

November 2: In the matter of the application of the Ericson Telephone Co. for authority to establish and collect rates for switching farm lines, order issued authorizing the collection of $7 a year gross or $6 per net annum.

NEW YORK PUBLIC SERVICE COMMISSION

October 29: Special permission granted to the Rochester Telephone Corp. to reduce the additional charge for handset telephones from 25 cents to 15 cents per month, effective November 1. The commission has discontinued and closed its investigation of the rates of the company which was brought on complaint of the mayor of the city of Rochester.

OHIO PUBLIC UTILITIES COMMISSION

October 30: Northern Ohio Telephone Co. and Boughtonville Telephone Co. ordered to appear before commission for a hearing on their failure to supply toll service in Huron County.

November 6: Hearing on complaint of Ohio Bell Telephone Co. against Northern Ohio Telephone Co., of Bellevue, concerning long distance operating methods. Hearing continued to this date from November 1.

WISCONSIN PUBLIC SERVICE COMMISSION

October 15: Pointing out that all telephone companies in the state rendering service in more than one community have complied with its general order reducing handset charges, the commission issued a general order to all smaller companies to stop charging higher rates than those fixed in the first order if they render handset service.

Companies, which do not furnish handset service, were directed to file information to that effect not later than November 1.

Maximum charges fixed for handset service by the commission are 25 cents a month for not more than two years or 8 cents continuing charge monthly.

The Lincoln Telephone & Telegraph Co., Lincoln, Nebr.

ANOTHER COMPANY WRITES ABOUT "PAY STATION PROFITS"

Printed below is a letter written by H. F. McCulla, General Commercial Superintendent of the Lincoln Telephone and Telegraph Co., in which he tells about his company's profitable experience with pay station equipment.

We have in service in the territory in which we operate, over five hundred public pay stations in addition to several hundred semi-public pay stations. Our average monthly revenue from pay stations in service is over $7.50 each.

Our highest yielding pay stations are located in one of our hotels in Lincoln where we have three stations installed. These stations average $66.02 each per month. We have two stations in our central office which average $54.67 each per month; two stations in the Bus Depot which average $40.02 each per month; four stations in one of the railway depots averaging $25.05 each per month; a station in one of our drug stores averaging $27.92 per month; and a station in one of our department stores which averages $18.00 per month.

Very truly yours,

H. F. McCULLA,

General Commercial Superintendent

Lincoln Telephone and Telegraph Company.

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Or any other telephone supply house

Progressive Company Installs New Equipment

By C. I. KUPPINGER
American Automatic Electric Sales Co.

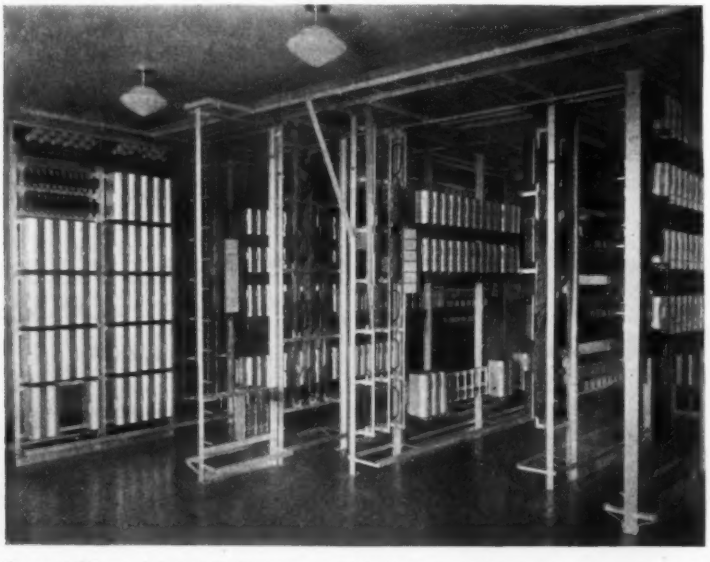
THE ATTRACTIVE new exchange building shown at the right was erected at Monroe, N. Y., by the Highland Telephone Co. in which to install new automatic equipment to serve its subscribers. The installation also includes a new six-position remote-control toll switchboard. The company standardized its telephone instruments

ON the evening of June 4, 1935, the Highland Telephone Co. of Monroe, N. Y., closed up its magneto exchange at Monroe and placed a new 300-line Strowger automatic line-finder type exchange in service.

The Strowger automatic exchange equipment, supplied and installed by Automatic Electric Co., Chicago, is housed on the second floor of an unusually attractive new building, erected on a 120 ft. by 240 ft. lot. This building was especially designed for the Highland Telephone Co.'s headquarters, the executive and business offices being located on the first floor.

A unique feature of the public business office arrangement is the absence of bookkeeper's and cashier's cages. A full-length "double-deck" counter provides facilities for the transaction of company business, thus presenting an inviting and homey atmosphere. The lower deck of the counter is for the use of the clerical staff, and is practically concealed from view from the customers' side of the counter. Two modern telephone booths are also located in the business office for the convenience of the public.

In addition to the Strowger automatic switching equipment, the installation includes a new six-position, Strowger remote-control (cordless) toll switchboard. This toll board has no jacks, plugs or cords—standard Strowger switches, under control of the toll operators, performing all the mechanical work of setting up the toll connections.



General View of Local Switchroom of Highland Telephone Co., Monroe, N. Y.

The telephone instruments used on this installation are all monophones, self-contained desk type, also a product of Automatic Electric Co. This is the first instance on record of a company standardizing completely on these modern self-contained instruments.

Automatic, flat-rate, selective-ringing service is provided for individual and party lines. Two-party, four-party and five-party lines employ bridged ringing; and ten-party lines, divided ringing with five ringers connected to either side of the line and ground.

Each subscriber's number consists of four digits. The first digit selects the proper connector hundred group; the next two digits select the desired line in the particular hundred group, and the fourth digit determines the required ringing frequency and the side of the line over which the ringing current is to be sent.

Reverting calls on party lines are made by dialing a three-digit code consisting of the digit nine and the last digits of both the calling and called parties' numbers.

Code number "8" is dialed for information service. This code selects a trunk to the information position of the toll board. The release of the trunk is under the control of the calling subscriber. Code number "0" is dialed for

New Building of the Highland Telephone Co. at Highland Mills, N. Y., Which Houses an Unattended Strowger Automatic Exchange.

toll or long distance service. The calls are received at the toll positions over toll finder and link circuits. The toll operator extends the call to the desired toll point while the subscriber waits on the line.

In case the desired party cannot be reached, the calling subscriber is dismissed and the connection then completed on a delay basis. When necessary, the toll operator can re-ring calling subscribers on the CLR trunks. The release of all CLR connections is under the control of the toll operator.

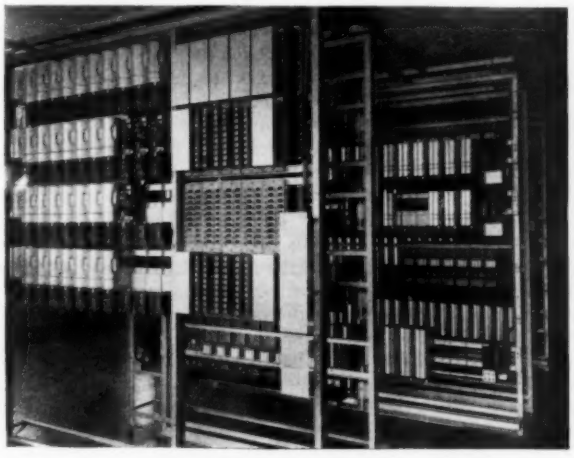
Ringing current is supplied by a duplicate set of five-frequency harmonic converters furnishing frequencies of 30, 42, 54, 66 and 20 cycles respectively, with a transfer circuit for automatically switching from one ringing machine to the other.

The power plant consists of a two-panel floor-type power board, a 46-volt 186-ampere-hour storage battery, and associated charging equipment. The power circuits also provide for the automatic stop-and-start charging method, the charging rate being adjusted to approximate the average day-time discharge rate without permitting the exchange voltage to fall below the 46-volt low limit under normal operating conditions. A complete set of supervisory and alarm circuits are included in the power equipment.

As previously stated, the toll switchboard is of the remote control (cordless) type with standard Strowger switches performing the mechanical work of completing the toll connections. The circuits are designed to so operate that the toll lines and the automatic-exchange trunks are available to all operators. The operation is similar to that of CLR cord-type toll boards except the method of receiving and extending calls.

The lines and trunks terminate in Strowger switch banks instead of jacks. Simplified links, which are analogous to cord circuits, terminate in switches controlled by keys mounted on the key-shelves. Supervisory lamps perform the same functions for supervising connections. In most respects the arrangement of the key-shelves is identical to that of the cord type boards. A calculagraph for timing the toll tickets is mounted between each two positions in the customary manner.

All of the cord circuit facilities associated with a conventional plug and cord-type toll board are available on the toll board. The toll operators may



Line Finder Equipment in the Monroe, N. Y., Exchange.

CARRY Just One SQUARE BATTERY

- Every time you remove two old round No. 6's replace them with one BURGESS TWIN-SIX 3-Volt Telephone Battery. Carry just one square, compact battery instead of two bulky round batteries. Carry 40% less weight, 30% less bulk. Make two connections instead of four!
- The BURGESS TWIN-SIX 3-Volt Telephone Battery will give your subscribers a strong, even talking current. Protected by the patented Burgess Chrome Formula, it has an unusually long life. Its tough, heat-welded jacket has been water and moisture proofed for telephone service.
- When you order 30 or more TWIN-SIX Telephone Batteries, they will be shipped F.O.B. your exchange. Send your orders to Inland Equipment Co. Price is only 39c (47c west of the Rockies), terms 5% 10 days, net 30.

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impulse in either direction, ring in either direction, split the connection on either side, collect or refund coins, monitor, and release the connections on either side. The traffic is automatically distributed among the operators. Future additions to the switchboard can be made without interference with the existing equipment or service.

The toll lines and exchange trunks are wired to bank contacts of Strowger line-finder switches for incoming calls to the toll board, and to bank contacts of connector switches for outgoing calls. An incoming call to the toll board over a toll line causes a pilot lamp in each position to glow.

Any operator may answer by throwing the "talking" key of an idle link circuit, which will cause the associated line-finder switch to connect with the calling line. The toll operator can then talk, ring or perform any other required function over the toll line, and the distant operator may re-ring on the line when necessary. The release of the connection is under the control of the Monroe toll operator.

Incoming calls to the toll board over the exchange CLR trunks operate in a similar manner to that described in the preceding paragraph for incoming toll line calls. Switch-hook supervision is received from the Monroe subscriber, and the release of the connection is under the control of the toll operator.

"Group identify" lamps are located in each toll position for the purpose of identifying the class of service to which a calling line is entitled, or the group number of a calling toll line. By this means the toll operator is advised when a pay-station line is calling or from what town a toll line is signaling.

Outgoing connections from the toll board to toll lines or to automatic-exchange lines are made by means of automatic "senders" which are operated from a set of dial push keys located on each keyshelf. The toll operator sets up the required digits on the push keys and then operates the "start" key. The proper combination is thus established on the sender, and the impulses are automatically relayed to the switches in proper sequence and timing without further attention by the operator.

Each position is so equipped that the toll operator may set up a second connection on a second set of push keys while the sender associated with the first set of keys is transmitting impulses to the switches. The operator's speed is materially increased by the use of automatic senders.

The switches associated with the toll board circuits are mounted on standard mounting racks in the automatic switch room. The relays associated with the toll board line, trunk, and positional circuits are of the automatic "horizontal" type, and are mounted in groups on base plates in a manner similar to the automatic exchange repeaters. These relay groups are mounted on separate toll equipment mounting racks in the automatic switch room, and may be identified at the extreme left-hand side of the general view of the automatic switch room.

Six-Position Strowger Remote Control Toll Board Installed at Monroe, N. Y., for the Highland Telephone Co.

The Highland Telephone Co. also owns and operates telephone exchanges at Highland Mills and Washingtonville, N. Y.

George B. Mailler, a pioneer telephone man in New York state, has been president of this company since its organization in 1899. F. H. Florance, secretary and general manager, has been largely responsible for the successful operation of the company, having acted in his official capacity continuously since 1906. In recent years he has been ably assisted by his son, F. S. Florance, who has played an important part in planning the conversion of these properties to automatic operation.

SEYMOUR GUTHRIE, PROMINENT TELEPHONE MAN, PASSES ON

IN the death on October 30 of Seymour Guthrie the Independent telephone cause loses one of its staunch and well-known supporters. No man in the industry seemed to endear himself as a personal friend to all with whom he came in contact so much as the genial secretary and treasurer of

Kellogg Switchboard & Supply Co., Chicago.

Mr. Guthrie was born in Buffalo, N. Y., on June 19, 1864. As a young man he was a traveling auditor for Armour & Co. and was one whom the branch manager knew would be loyal to his employer and equally fair with him. They were glad to see this auditor and knew that his reports would have a human quality and a fair statement, unless something were radically wrong. It was inbred in him, even as a young man, to make friends with all with whom he came in contact, even though business interests or position might be adverse.

Mr. Guthrie was attracted to the telephone business early and became secretary and treasurer of Kellogg Switchboard & Supply Co. in 1902, just five years after the company was organized. He occupied this position until his death. He had a host of friends and will always remain a pleasant and vivid recollection to those with whom he was so intimately associated for so many years in the administration of the Kellogg company.

It is a remarkable compliment to his efficiency that during all of those years in which he passed upon credits, the losses of the company from bad debts in the telephone business were less than one-half of one per cent. And it is an equally unusual testimonial to say that this was not accomplished at the expense of the good will of the customers with whom he had to deal. Throughout his long life he kept their respect and became the warm personal friend of all of those with whom it was his privilege to come in personal contact.

Mr. Guthrie was one of the old settlers and prominent citizens of Riverside, Ill., a suburb of Chicago. He was active in the civic affairs and all public questions that affected the life and welfare of the village. He was active also in other organizations and in public questions of the day, and always in the interest of their solution along sound and unselfish lines.

In his death, Kellogg Switchboard & Supply Co., the telephone industry and the community where he lived, have suffered an irreparable loss.

He was a member of the Episcopal Church, Riverside Golf Club, and Chicago Athletic Association. He is survived by his wife, Martha, a daughter, Mrs. Harriet Evans, and a son, Seymour Ashley Guthrie, a prominent lawyer of Chicago. Mr. Guthrie had another daughter, Mrs. Martha De Leuw, who died 15 years ago.

Modern Dial Service For Mayer, Minn.

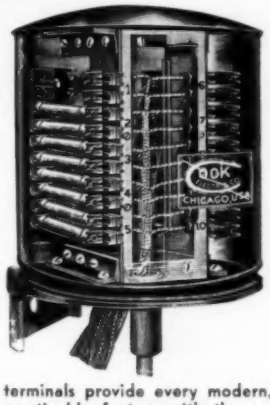
The subscribers of the Mayer, Minn., exchange of the Watertown Telephone Co. are now enjoying modern dial automatic service. Frank A. Mattson, president and general manager of the Watertown company, states that the subscribers are enthusiastic in its favor.

An attractive exchange building has

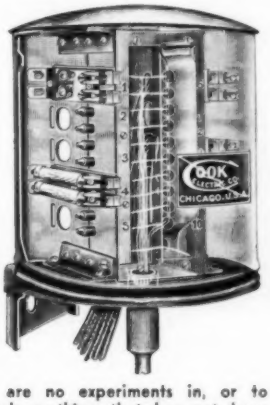
(*Concluded on page* 36)

COOK

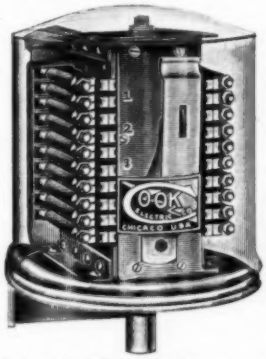
protected terminals are recognized throughout the world because they have proven satisfactory in the past and are improved for the future.



These terminals provide every modern, desirable, practicable feature with the assurance of satisfactory service.



There are no experiments in, or to these terminals, nothing that has not been tried, and tested for years in the field.



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Cook S-16-D with demountable protector mounts.

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"Telephony's" Engineering Data

By B. C. Burden.

Index, Subscriber Set Repair.
November 9, 1935.
No. 9-C, Page 1.

Operators' Telephone Sets

So far as service and utility to the subscriber are concerned, the operator's telephone set and its circuit is second in importance only to the line and cord circuits and the equipment associated with them. It is her only means of communication with subscribers calling into the central office.

Since there is only one operator's set to a position with from 6 to 15 cord circuits and as many as 400 lines, it is easy to see that defects occurring in the operator's telephone can affect the quality of service to the subscriber. For instance, poor transmission may result in the operator's misunderstanding a subscriber's request for a connection, causing confusion and delay in rendering the desired service.

It is the purpose of this data sheet to discuss the types of operators' telephones in common use, the types of circuits employed, and methods of maintaining the sets.

Types of Operator's Telephone Sets

There are, in general, three types of operators' telephone sets used on switchboards, as follows: (a) breastplate transmitter; (b) suspended transmitter; and (c) handset.

The breastplate transmitter type of telephone set is most commonly used in magneto and common battery exchanges where operators are regularly on duty. This type of set was devised years ago to meet requirements for a telephone which would permit the operator to perform necessary duties in connecting subscribers and, at the same time, insure satisfactory communication with the subscriber by keeping the transmitter constantly in front of her mouth. In this way her hands were left free to handle the cord and key equipment of the switchboard and her operating efficiency was greatly improved thereby.

This type of telephone consists of a transmitter mounted on a breastplate and provided with a movable horn-style mouthpiece which curves towards the mouth, a watchcase type of receiver and head band, and a cord and plug to connect, through a jack in the switchboard shelf, the transmitter and receiver to the proper circuit in the switchboard.

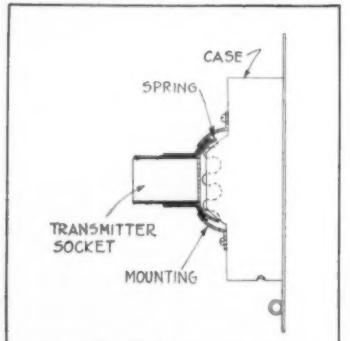

FIG. 1. OPERATOR'S TELEPHONE TRANSMITTER—SHOWING CROSS-SECTION OF SOCKET AND UNIVERSAL JOINT.

"Telephony's" Engineering Data

By B. C. Burden

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The adjustable mouthpiece feature is obtained by means of a rocket and universal joint mounting, Fig. 1. This enables the operator to adjust the mouthpiece to a suitable position in front of her mouth. The breastplate itself is supported on the operator's chest by a neckband passing over the back of her neck. The receiver headband, of course, provides a means of properly supporting the receiver over her ear and is designed to fit comfortably over the operator's head.

The cord, which is of the proper length to give the operator sufficient freedom of action (about four feet for the operator at her position and six feet for the supervising operator, as measured from the breastplate), is connected to the telephone circuit in the switchboard by a four-conductor plug-and-jack arrangement. This plug-and-jack arrangement enables the operator to have her own individual head telephone set, which is a desirable feature from the viewpoint of sanitation; also the maintenance of the set is rendered simpler inasmuch as an extra unit can be held in reserve and substituted in case the original set becomes defective. Fig. 2 illustrates a typical operator's set of the breastplate type.

FIG. 2. BREAST PLATE TYPE OPERATOR'S HEAD SET.

The suspended transmitter type of operator's telephone is used chiefly on switchboards in small magneto exchanges where traffic is light and an operator is, therefore, not required to be constantly on duty at the board. This type of transmitter is also utilized on small private exchange boards where the operator is required to perform secretarial duties, in addition to taking care of calls going through the board.

In the latter case, the use of a breastplate transmitter would interfere with her extra work, and would be especially unnecessary if the number of calls coming into the switchboard were small so that her actual operating time is short in comparison with the time required for her other duties.

"Telephony's" Engineering Data

By B. C. Burden

Index, Subscriber Set Repair.
Nov. 9, 1935.
No. 9-C, Page 3.

The transmitter is suspended from the top of the switchboard by means of an extension arm which swivels on a mounting attached to the top of the cabinet and from which the transmitter dangles on the ends of a pair of flexible conductors supported by the extension arm. A watchcase receiver with headband is utilized and connected to the telephone circuit in the switchboard by a two-conductor plug-and-jack arrangement.

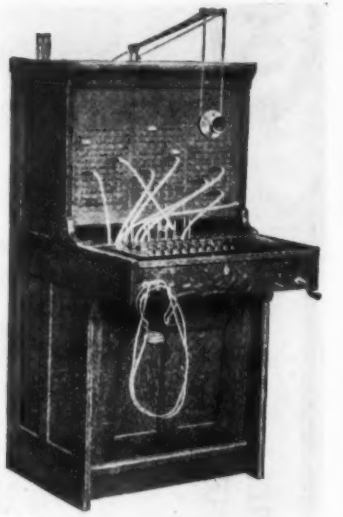


FIG. 3. SMALL BOARD WITH SUSPENDED TYPE TRANSMITTER

Fig. 3 shows a suspended type transmitter on a magneto switchboard.

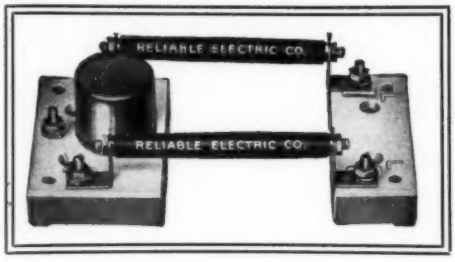
The handset type of operator's set is a recent innovation introduced to further improve the advantages of the suspended transmitter telephone; it is becoming especially popular in small private branch exchanges because its use obviates the necessity for utilizing a receiver and a headband.

A regular type of handset, such as is used on handset telephones, is employed and connected to the telephone circuit in the switchboard by means of a four-conductor plug and jack. A hanger is provided on one side of the switchboard cabinet to accommodate the handset when not in use.

Operator's Telephone Circuits

Since the type of operator's telephone circuit utilized in a switchboard has an important influence on the quality of service rendered to the subscribers, a short description of two circuits in general use will be given. These are the ordinary induction coil and the anti-side tone circuits; both are illustrated in Fig. 4.

The ordinary induction coil circuit, as may be noted by reference to Fig. 4-A, is essentially the same as the one utilized in a subscriber's telephone. This circuit is satisfactory for quiet locations where there is little or no room noise to disturb the conversation of the operator with the subscriber.



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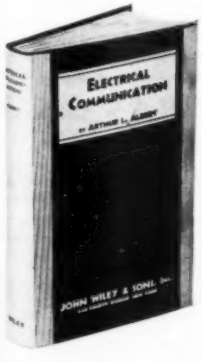

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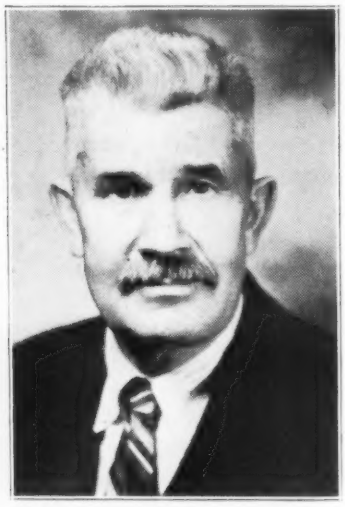
been provided to house the new dial automatic equipment. The walls are of hollow tile construction, while the ceiling and floor are composed of concrete.



FRANK A. MATTSON, President and General Manager of the Watertown (Minn.) Telephone Co., Which Has Installed All-Relay Automatic Unattended Exchange at Mayer, Minn.

Since the North all-relay equipment is unaffected by high and low temperature extremes, the building does not contain any provisions for heating.

The North all-relay switchboard is equipped with 50 lines and five links. The new equipment has all the latest features, such as line lockout and complete reverting call service on all party lines.

As the Mayer exchange has an extremely heavy telephone saturation in the rural districts, ten-code ringing is provided. It is arranged to give 20-party semi-selective ringing, should it be desired. The entire outside plant is provided with metallic circuits and the ten codes may be rung on either the positive or the negative side of the line.

The toll and information calls originating in the unattended Mayer exchange are taken care of at the toll board in Watertown, which is the headquarters of the company.

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The Manufacturers' Department

Patent Granted for Sani-Dial Finger Wheel

A device known as the Sani-Dial has been placed on the market by the Telephone Dial-Finger-Wheel Corp., of Albany, N. Y., which claims these seven features for a finger wheel for a telephone dial: Free access to clean the number-plate, constant number visibility, light reflection to the number-plate, light weight, chrome-plated front and back, numbering on sani-dial, pad-lock type dial-lock with every sani-dial if desired.

By means of eliminating the space between the digits 1 and 0, one has ready access to the number-plate for removing dust and making the numbers readily visible. There is no blind period for a portion of the number-plate while dialing the various digits of a number.

The manufacturers assert that no interruptions to service or damage to the instrument can result from its use. It is quickly installed by removing the snap-on call number retainer and one nut. It is designed "to improve transmission of impulses and simplify dialing and maintenance of the automatic telephone of the finger wheel type."

The Telephone Dial Finger Wheel Corp,. of Albany, N. Y., was granted United States patent No. 2015694 covering this on October 1.

• • •

International Harvester's Booklet on Safe Driving

Through what probably has set an all-time record for reprintings, millions of Americans have read in newspapers and periodicals the startling article from Reader's Digest entitled "—And Sudden Death," by J. C. Furnas. A masterpiece of stark, unrelenting realism, recounting to the last terrifying detail the horror and suffering witnessed every day at scenes of highway smash-ups, the article has, by sheer shock, aroused the public conscience to the need for more careful driving.

As if timed from the receptive mood created by Mr. Furnas' article, a 64-page, pocket-size booklet entitled "I Drive Safely" has been published by the International Harvester Co., 606 South Michigan Ave., Chicago, for free distribution. It is available to all drivers of motor vehicles sufficiently interested in improving their driving to apply for copies. Hundreds of motor truck fleet operators have applied to the company

(*Concluded on page* 38)

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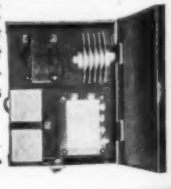

Buyer's Weekly Guide

A list of firms and companies offering equipment, supplies or services for operating telephone companies

ADDING MACHINES

Burroughs Adding Machine Company, Second Blvd., Detroit, Mich. — Adding, Bookkeeping, Calculating, Billing and Accounting Machines, Electric Carriage Typewriters, Standard Typewriters, Operator Correct-Posture Chairs. Burroughs machines are in use today in hundreds of progressive telephone companies throughout the country.

BATTERIES—DRY CELLS

Burgess Battery Co., Freeport, Ill.—Burgess Flashlights and Uni-Cel Flashlight Batteries—for dependability and service. The Burgess Twin-Six Telephone Battery—a 3-volt unit designed to replace two No. 6 cells, with longer life, lighter weight, smaller size and a leakproof case. The Burgess Little-Six—replaces the old type No. 6 cell, is smaller and lighter, will not ooze or bulge, has all the electrical capacity of the standard No. 6 cell.

National Carbon Company, 30 E. 42nd St., New York.—"Columbia" Telephone Dry Batteries; "Eveready" Flashlights, Flashlight Batteries and Long Life Dry Cells, "National Pyramid" brushes, carbon, graphite and metal graphite for motors, generators and rotary converters. "Eveready" Prestone anti-freeze; "Eveready" Rustone rust preventive; and "Eveready" Air Cell telephone operators' transmitter batteries.

Ray-O-Vac Company, Madison, Wis.—Ray-O-Vac telephone batteries — longer life and better service proven by tests in accordance with U. S. Government standards and records of users. Ray-O-Vac flashlights and industrial flashlight batteries are other items showing Ray-O-Vac's outstanding quality.

BATTERIES—STORAGE

The Electric Storage Battery Company, Allegheny Ave. and 19th St., Philadelphia, Pa.—Exide Storage Batteries. Branches: Boston, New York, Rochester, Philadelphia, Pittsburgh, Washington, Atlanta, Cincinnati, Cleveland, Detroit, Chicago, Kansas City, Minneapolis, St. Louis, Denver, San Francisco and Seattle.

Philco (Battery Division) Tioga and C Streets, Philadelphia, Pa. — Philco- Steel Glass Storage Batteries for P.B.X and central office operation. Your old batteries will command a liberal allowance toward any Steel-Glass cell from 10 A.H. to 1040 A.H. Write now for catalog . . . it will tell you the complete story of Steel-Glass —the finest of Telephone Batteries.

BATTERY CHARGING EQUIPMENT

General Electric Company, Bridgeport, Conn.—Tungar battery chargers. G-E pole line hardware. Cable filling compound.

CABLE—LEAD ENCASED

American Electrical Works, Phillipsdale, R. I.—Paper telephone cable, switchboard cable, bare copper wire. Chicago Office: 20 N. Wacker Drive; Cincinnati: Traction Bldg.; New York: 100 E. 42nd St.

British Insulated Cables, Ltd., Surrey House, Embankment, W. C. 2, Factory: Prescot, Lancashire, England.—Telephone cable of all sizes and capacities.

General Cable Corporation, 420 Lexington Ave., New York, N. Y.—Paper telephone cables of standardized manufacture for over forty years. Weatherproof and insulated copperweld drop wire.

Eugene F. Phillips Electrical Works, Ltd., Montreal, Can.—For any type of wire or cable used in telephone, telegraph or power work get in touch with "Phillips." Manufacturers of bare and insulated copper wires, rubber insulated wires, enameled wire, magnet wire, telephone cables, power cables, switchboard cables, flexible cords, copper rods, etc.

CABLE RINGS

National Telephone Supply Company, 5100 Superior Ave., Cleveland, Ohio.—National Cable Rings, National Splicing Sleeves, Non-Breakable Messenger Cable Hangers, Marlin and Swisher Cable Hangers and Custom Galvanizers. National cable rings are practical because they are two-way,—they allow the cable to be pulled in either direction. National sleeves make secure the weakest points in the line. If it's a splice—make it a National.

CABLE TERMINALS

Cook Electric Company, 2700 Southport Ave., Chicago, Ill.—Protective Pole Cable Terminals, Unprotected Pole Cable Terminals, central office protection, lighting arresters, sleeves, fuses.

Reliable Electric Company, 3145 Carroll Ave., Chicago, Ill.—Complete line of cable terminals, telephone and switchboard protectors, sleeves, fuses, solderless wire connectors and specialties.

CARBON DIAPHRAGMS

Noris Carbon Company, Inc., 160 5th Ave., New York, N. Y.—Carbon diaphragms, carbon back plates, granular and globular carbons, lightning arresters.

CONDUIT

Brazil Hollow Brick & Tile Company, Brazil, Ind.—Makers of Brazil Vitrified Tile. Conduit.

CORDS, CABLE AND WIRE

Lenz Electric Manufacturing Co., 1751 N. Western Ave., Chicago—Established 1904—telephone and switchboard cords for all makes of equipment, braided and lead-covered telephone cable, flame-proof jumper wire, interior telephone wire, switchboard wire.

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Runzel Cord & Wire Co., 4727-31 Montrose Ave., Chicago—Telephone and Switchboard Cords, Flame-proof Jumper Wire, Switchboard Wire, Interior Telephone Wire. W. L. Runzel, President, has devoted over 40 years to the making of fine telephone cords.

ELAPSED TIME RECORDERS

Calculagraph Company, 50 Church St., New York, N. Y.—Calculagraph is the world's standard elapsed time recorder and gives you toll records printed with elapsed time to the second. Both spring driven and electric motor models are available.

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H. Sigalet & Company, Ltd., Lumby, B. C., Canada — Western Red Cedar Poles. Plain or Butt treated.

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American Automatic Electric Sales Company, 1033 West Van Buren Street, Chicago, Ill.—Public Automatic Telephone Systems, Private Automatic Telephone Systems, Central Battery and Magneto Manual Telephone Switchboards, Remote Control Switchboards, Telephone Instruments of all types, Battery Eliminators, Charging Equipment, Signaling and Control Apparatus, Cords, Wires, Cables, Monotype Copperweld Drop Wire, and a complete line of construction materials and supplies.

Automatic Electric Company, 1033 W. Van Buren St., Chicago, Ill.—Public Automatic Dial Systems, Private Automatic Dial Systems, Telephones, relays, signaling and control equipment.

Automatic Electric Company, Ltd., Milton Road, Edge Lane, Liverpool, England. —Automatic Telephone Equipment.

Automatic Electric Sales Company, Ltd., 1027 W. Van Buren St., Chicago, Ill.—Public Automatic Dial Systems, Private Automatic Dial Systems, Manual Telephone Equipment, telephones, storage batteries, wire, cable, poles, etc.

Kellogg Switchboard & Supply Company, Adams & Aberdeen Sts., Chicago, Ill.—Engineers and designers, manufacturers and suppliers of complete equipment for telephone exchanges and communication systems. Manufacturers of "Master-built" Common Battery, Magneto and PBX Switchboards, "Masterphone" Telephone Instruments, and a complete line of telephone supplies, including bronze drop and interior wire.

North Electric Manufacturing Company, Galion, Ohio—Machine switching telephone systems. Automanual and Automatic. "All-Relay" Switching Apparatus (Dialless and Dial Control). Unattended Satellite Systems.

Siemens Brothers & Company, Ltd., Woolwich, England—Automatic and Manual Telephone Equipment.

Stromberg-Carlson Telephone Manufacturing Company, 100 Carlson Road, Rochester, N. Y. — Telephone apparatus of all kinds, switchboard cords, cable and general telephone supplies.

TOOLS

Crescent Tool Co., Jamestown, N. Y.—CRESTOLOY Pliers, Curved Needle Nose Pliers, Heavy Diagonal Cutting Pliers, Linemen's Side Cutting Pliers, End Cutting Nippers, Crescent Hack Saws.

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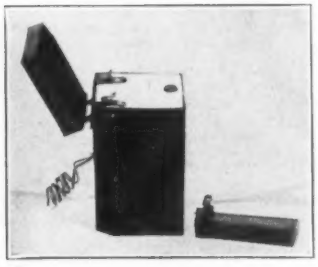

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POSITION WANTED—Young man, telegraph and telephone inside maintenance and engineering experience. Have excellent record in Bell, foreign and international service. Address 8488, care of TELEPHONY.

POSITION WANTED — Commercial representative, 7 years with Bell System, university graduate, age 32, capable, aggressive, thoroughly familiar with business office and sales practices. Address 8483, care of TELEPHONY.

POSITION WANTED — Secure new business, stop cancellations of subscribers! Commercially experienced telephone man, as special agent, can obtain surprising results. A-1 reference. Moderate salary. Address 8474, care of TELEPHONY.

ACCOUNTANT, 30 years of age, college graduate, 8 years' experience in class "A" telephone accounting. Capable of taking charge. Address 8475, care of TELEPHONY.

FIRST CLASS CABLE SPLICER, experienced in all kinds of plant work, wants position; 15 years' experience. Address 8480, care of TELEPHONY.

(*Concluded from page* 36)

for copies for distribution to their drivers.

"I Drive Safely," a book of instruction for drivers of trucks and buses, is attractive in typography and illustrations, with terse treatment of its subject matter arranged under chapter headings for quick reference and review. It leaves nothing unsaid for any one seriously desiring to contribute to street and highway safety.

Pointedly illustrated for a ready grasp of safe-driving fundamentals, some of the subjects treated are: Speed, brakes, hilly roads, carbon monoxide, rules of the road, railroad crossings, safety loading factors, steering, tires, congested traffic, lubrication, slippery roads, vision, mechanical equipment, lights, pedestrians, garage accident hazards, and miscellaneous safety factors to which a separate chapter is devoted. Proper maintenance of the motor vehicle is also outlined in nontechnical language.

Publication of this educational booklet as an aid to safety campaigns conducted both by communities and private fleet operators was suggested by International Harvester employes whose objective is the elimination of industrial accidents and whose cooperative efforts have brought about an outstanding reduction in such accidents.

• • •

New Magnetic Alloy Lifts Sixty Times Its Weight

During a visit of corporation executives and bankers to the research laboratories and works of the General Electric Co. at Schenectady, N. Y., late last month, announcement of an important new discovery was made. It dealt with a new alloy which is magnetic and which can lift 60 times its own weight.

The alloy is called "alnico" because it is a combinatoin of aluminum, nickel and cobalt, which three metals are added to iron. Like other permanently magnetic metals it does not magnetize easily. By the same token it does not lose its magnetism readily. Unlike other magnetic metals it retains its attractive and repulsive power at high temperatures.

As a result of this development, permanent magnets will probably displace electromagnets in loudspeakers and various control and electric devices, with a considerable saving in cost and greater simplicity of construction.

The alloy cannot be machined like iron but must be cast and then shaped by grinding. Small parts, however, can be pressed in powdered form and then finished in the usual way.

It was predicted that one of the great applications of alnico would be in the making of transformers.